INDUSTRIAL ENGINEERING

ELECTRICAL, MECHANICAL AND PLANT SERVICE IN INDUSTRY

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L. C. MORROW, *Editor*

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Not only what to do and when to do it, but . . .

What to Do It With

. . . Having the right equipment on the job at the right time is essential in the plant engineering division of industry when complete service to production is to be rendered.

. . . Production of commodities at costs low enough to permit of wide sale is the background of our prosperity.

. . . Elimination of waste, improved methods and equipment, better management, and more nearly complete service to production by plant engineering departments have been at work since the great War to bring about our constantly decreasing costs of production.

. . . Less spectacular than production itself, but of equal importance, is "service to production," the division of industry responsible for keeping production equipment and plant in operating condition.

. . . The human element and the machine element divide the burden of responsibility involved in service to production.

. . . Of what use the individual plant engineer, superintendent, master mechanic, chief electrician—who does the plant engineering, unless he knows what to do, when to do it, and what to do it with?

. . . Of what use mechanical power transmission apparatus, motors and controls, materials handling devices, mechanical and electrical repair shop tools, if they are unable to perform their functions in whole or in part? If they are obsolete, poorly selected, improperly installed? If operated under conditions of lighting, temperature, or atmosphere that prevent efficiency?

. . . *Industrial Engineering's* monthly job is to so instruct the individual concerned with plant engineering that he will know what to do, and when to do it—a service dealing with the human element. As a part of this instruction it includes monthly descriptions of New Equipment, which show what to do it with—a service dealing with the machine element.

. . . However, *Industrial Engineering* recognizes that the important place of equipment in service to production justifies the presentation in one unit of essential facts concerning equipment made available by manufacturers during a unit of time longer than the month.

. . . The presentation is made in this issue, and the unit of time is one year, the calendar year 1928. The issue is, editorially, a guide to the latest in equipment. Supplemented by the advertising pages it furnishes an equipment reference that will add greatly to the plant engineer's knowledge of what to do and when to do it by showing him what to do it with. It is an issue designed to be kept on the desk as a constant service in the selection of the right equipment at the right time.

Transmission of Power

To the Driven Machine

By William Staniar

Chairman of the Advisory Board, Power Transmission Association, Power Transmission Engineer, E. I. du Pont de Nemours & Company and Subsidiaries

In the early days of industrial plant operation, the prime mover was usually a large steam engine. Power was distributed throughout the plant by means of thick, heavy belts and long lineshafts. In recent years, this situation has been changed by the introduction of other and more efficient types of prime movers available in small capacities and by the many important improvements that have been made in mechanical power transmission equipment.

Modern mechanical transmission systems may be classified as follows:

1. Direct, motor-coupled connection.
2. Direct, motor-belt connection.
3. Director, motor-chain connection.
4. Belt and lineshaft group system.
5. Gear reduction unit system.
6. Open-gear connection system.
7. Multiple-fabric and manila-rope systems.
8. The variable-speed connection unit.
9. The combination of mechanical driving methods.

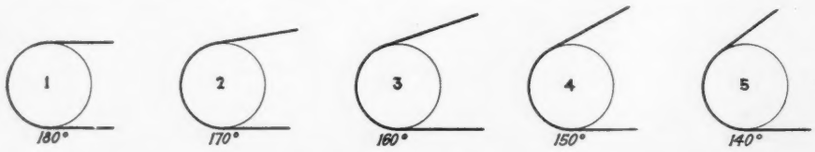

FIG. 1—AS THE RATIO between the size of the pulleys increases, the arc of contact on the small pulley decreases. In this illustration diagram *1* represents the ideal condition. With 170 deg. arc of contact, diagram 2, the power rating must be decreased 4 per cent. With a 160-deg. arc the reduction is 8 per cent; with 150 deg. arc the reduction is 13 per cent and at 140 deg. it becomes 17 per cent.

* * * *

Direct, Motor-Coupled Connection—This method is most extensively employed for driving modern machine tools, because the speed reduction generally necessary can be taken care of by the internal gears of the machine tool. The connection between the motor and the power-receiving shaft should be a coupling of the flexible type.

Direct, Motor-Belt Connection—This method employs a belt as the connection between the motor and the power-receiving shaft and is also extensively used for machine-tool driving. With this method, any speed ratio up to 6 to 1 is practicable.

Direct, Motor-Chain Connection—In this method chains of various types are employed as the connection between the motor and the driven shaft. It is successfully used on machine tools, miscellaneous apparatus, and lineshaft drives. Ratios up to 7 to 1 on short centers are practicable. The chain drive is positive.

Belt and Lineshaft Group System—This is known as the "group" system of driving, and is the most widely used method of transmitting power in industrial operations. Group driving is most practicable when power requirements range from 5 to 50 hp. The driven machine or apparatus can be belted from the line directly or through countershafts. With this system, the size of the prime mover may be based on the aggregate of the running loads of the machines driven, rather than on the starting loads.

Gear Reduction Unit System—In many industrial operations, the power-receiving shaft of machines must run at slow speed. Electric motors operate at high speed. Ratios of 50 or 100 to 1 are frequent; hence the use of gear reduction units. Spur gear reducers can be had with ratios up to 500 to 1 and are employed where the reduction is in parallel. The worm gear reducer can successfully be employed on drives requiring ratios of 100 to 1.

Open-Gear Connection System—This is employed where extremely close centers and moderate ratios are desired. Rawhide or composition gears are used on the motor shaft to eliminate noise. Large apparatus operating at slow speeds is frequently geared directly to the motor.

Multiple-Fabric and Manila-Rope Systems—The multiple-fabric rope system is of recent development. The ropes are a combination of rubber and fabric of V-shaped construction, made endless, and operate on V-grooved wheels. Ratios up to 7 to 1 and extremely short centers are possible with this type of driving.

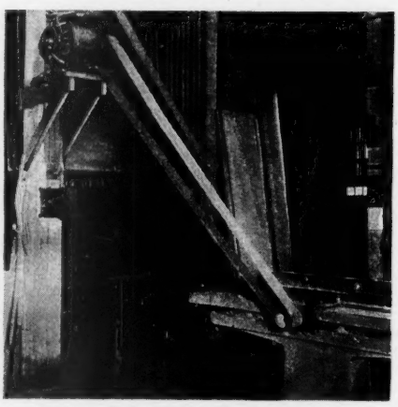

FIG. 2—THIS REPRESENTS an average center distance for belt drives. Here the belt is long enough to allow the natural elasticity of the leather to become effective in increasing the arc of contact and avoiding the necessity of operating under a high tension.

* * * *

There are now in use, two systems of manila-rope driving—the American or continuous method, and the English or multiple method. The American system employs one continuous rope winding over all of the

grooves, with the rope on the slack side forming a loop over an idler sheave, and a traveling tightener that automatically regulates the tension.

The English system uses separate and independent endless ropes in each groove of the wheels, depending on the weight of the ropes for tension and pinched grooves for adhesion. The English system is adaptable for large individual drives.

Variable-Speed Connection Unit—Numerous industrial operations require variations in applied speed without shock. In modern practice this is accomplished by variable-speed motors or by mechanical devices.

Combinations of Mechanical Driving Methods—It frequently happens that it is economy to employ a combination of the various types of driving for certain operations.

To drive mechanically requires a certain amount of floor or overhead space, the amount depending on the method employed; therefore, the drives should be considered first and not last, as is the usual practice. If ratios are low and ample centers can be had, it is poor economy to use anything else than the "group" system of belt driving. On the other hand, if space is limited and ratios are high, it is again poor economy to consider anything but the close-coupled installations, employing chains, speed reducers and the like.

CHOOSING the type of drive that will operate with the maximum efficiency and dependability under present-day conditions is not an easy matter. Many factors must be given careful consideration. In this article the author discusses some of these factors, from the background of his fifteen years of experience in solving power transmission problems in the huge plants of the du Pont company and the General Motors Corporation.

Speed ratio is a most important factor, because it generally indicates the type of transmission to employ. Availability of space is no excuse for employing shafting and belting when ratios of 25, 30, 50 or 100 to 1 are necessary. For such ratios worm or spur-gear reduction units should be considered.

The demands on the driven machine or apparatus have a bearing on the system of transmission to be employed. Many large and small machine tools are operated intermittently. Such machines should be driven through a coupling or belt, because when not in use the driving medium can be stopped, saving power and wear. Where machines are in continuous operation, the "group" system of driving is efficient and economical. This also applies to miscellaneous apparatus when ratios and space are given due consideration.

The method of control also has some bearing on the selection of transmission systems. In certain industries, it is necessary to change speeds or stop in the course of an operation, and then start under load. Unless a slip-ring motor is employed, direct connection by any rigid means is a source of trouble. For such operations, shafting with belts or chains should be employed and the load controlled either by a clutch or by shifting the belts.

The first cost of mechanical transmission equipment should always be considered, but not to the extent of deciding that the cheapest method is the best. In many instances, high initial expenditures are economical. This is true of belting, pulleys, clutches, and so on, because cheap material of this class not only gives short life, but increases maintenance costs. There is correct transmission equipment available for almost every driving condition and, regardless of first cost, an endeavor should be made to employ the system or method best suited for the conditions.

It must also be remembered that the finest belting and trasmission appliances are often ruined prematurely by lack of attention and carelessness of operation. Good-quality transmission equipment should be given the care and attention it deserves.

The transmission of mechanical power can be greatly facilitated if it is considered of primary importance in the drafting or design department of the company involved. The majority of apparatus in any manufacturing process must be driven; therefore, this phase of operation should be given primary consideration during the layout of the proposed machinery, particularly if the group system is to be employed.

MINIMUM CENTER DISTANCES BASED ON POWER AND REDUCTION RATIOS

Horsepower to be transmitted	Ratio of driver to driven	Center distance in feet	Horsepower to be transmitted	Ratio of driver to driven	Center distance in feet
1 to 4	2 to 1	4	50 to 74	2 to 1	13
	3 to 1	5		3 to 1	14
	4 to 1	7.5		4 to 1	16
	5 to 1	10		5 to 1	18
5 to 9	2 to 1	7	75 to 99	2 to 1	18
	3 to 1	8		3 to 1	20
	4 to 1	16.5		4 to 1	22
	5 to 1	12		5 to 1	24
10 to 14	2 to 1	8	100 to 124	2 to 1	20
	3 to 1	10		3 to 1	22
	4 to 1	12		4 to 1	24
	5 to 1	14		5 to 1	26
15 to 24	2 to 1	9	125 to 149	2 to 1	22
	3 to 1	11		3 to 1	24
	4 to 1	13		4 to 1	26
	5 to 1	15		5 to 1	28
25 to 39	2 to 1	10	150 to 200	2 to 1	26
	3 to 1	12		3 to 1	28
	4 to 1	14		4 to 1	30
	5 to 1	16		5 to 1	32
40 to 49	2 to 1	12	.....	.....	.....
	3 to 1	13	.....	.....	.....
	4 to 1	15	.....	.....	.....
	5 to 1	17	.....	.....	.....

The following factors are important:

Centers between Driver and Driven—Machinery should be located in relation to the lineshaft, so that the correct belt-center distances can be obtained to correspond to the horsepower and speeds required.

Shafting—The main lineshafts and all auxiliary shafts should be easily accessible for oiling and general maintenance.

Prime Mover—The prime mover should be located in an accessible position and in proper relation to the transmission equipment of the group.

Bearings, Pulleys, Clutches—The selection of these and other transmission equipment should be given considerable thought because on their proper choice depends to a great extent the efficient operation of the system and high or low maintenance costs.

Shafting and Belting—The diameter of the shafting governs the size of all other transmission accessories, with the exception of belting; therefore, the minimum diameter should be employed allowing a good factor of safety.

The selection of belting types and sizes should not be left to guesswork. The type should be based on the mechanical and atmospheric conditions surrounding the drive, and the method employed for joining the ends of this medium should be based on the same conditions.

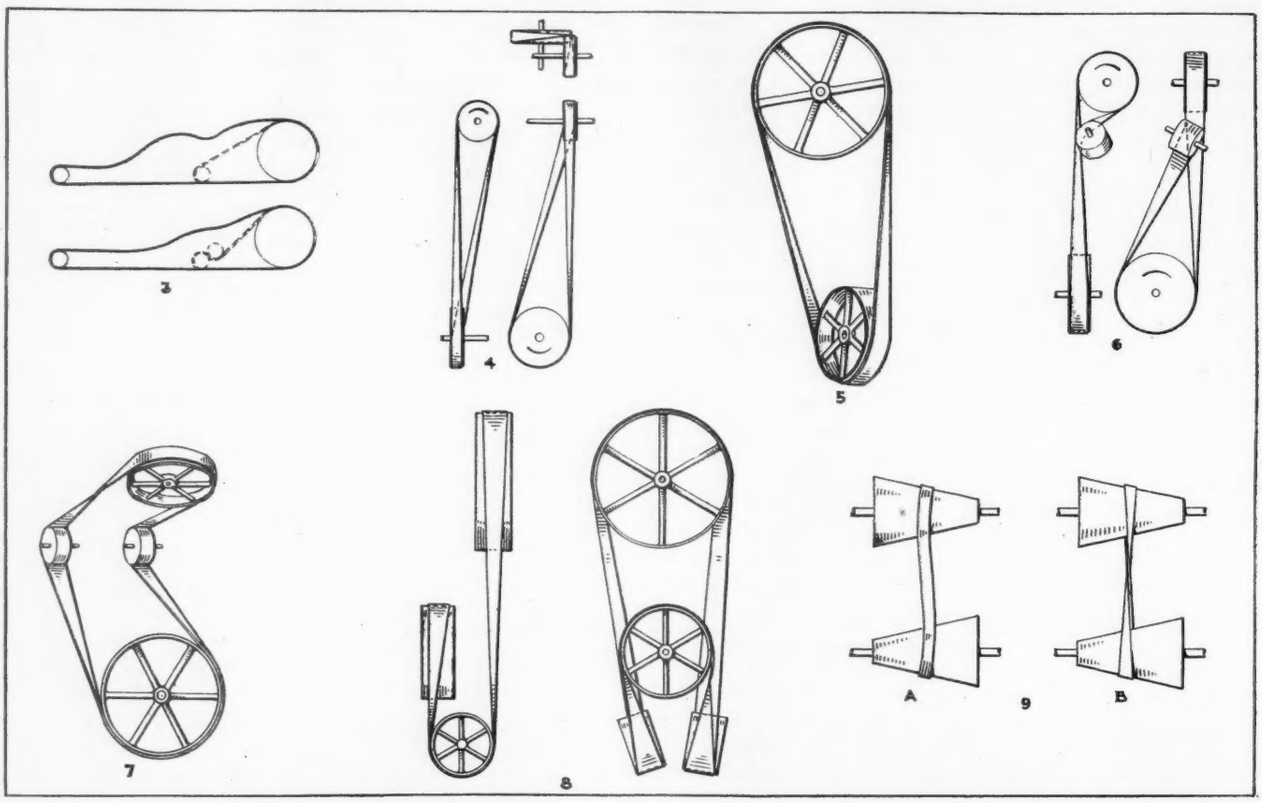

FIG. 3—TOO GREAT a distance between pulley centers will cause flapping of the loose strand of the belt, especially on intermittent loads. Fig. 4—This is a vertical, quarter-twist belt drive. For the best results leather belts of special construction should be used on such drives. Fig. 5—A semi-quarter-twist drive like this is sometimes used when the shafts are not exactly at right angles. Such installations should be avoided if possible, as they are very likely to give trouble. Fig. 6—Use of a fixed idler will eliminate some of the troubles encountered with quarter-turn drives when a belt of special construction is not available. Fig. 7—Mule or guide pulleys are used when power must be transmitted through belting from a horizontal to a vertical shaft. Fig. 8—This arrangement of mule pulleys is used when it is necessary to transmit power between parallel shafts that are not in the same plane. Fig. 9—On cone pulleys of extreme taper even narrow belts will, when running, take the form shown at *A*. This is because the edge of the belt is continually changing from the high side of one pulley to the low side of the other. Crossing the belt, as in *B*, gives better results.

* * * *

Belting affords an efficient method of transmitting power, but this efficiency is generally hampered by plant conditions that frequently are unavoidable. The following factors are important in belt drives:

Driving Ratios—A ratio of 1 to 1 on all ordinary belt drives produces the best results, because it gives an arc of contact of 180 deg. on the pulleys. As the ratio increases, the arc of contact decreases on the smaller pulley and the power capacity of the belt is proportionately lowered.

For belt drives having ratios over 6 to 1, a countershaft or other means of speed reduction should be employed. Fig. 1 illustrates the effect of various ratios on the arc of contact or wrap of the belt on the driving pulley. The effect of ratio on the power capacity of belting can readily be seen.

Center Distance—Too short a center distance necessitates a high-tensioned, or "tight," belt, causing excessive bearing friction, and short belting life. A tight belt lacks elasticity; therefore, load has little or no effect in increasing the arc of contact due to the sag of the loose side.

With a correct center distance based on the power requirements, the total elastic stretch is greater, resulting in an increased arc of contact due to the increased sag of the loose side of the belt, assuming that the tight side is below.

On a long-center drive a long belt is required, resulting in increased total elasticity, which causes sag and an increase in the arc of contact. An average center distance is shown in Fig. 2. However, an excessively long center distance, particularly where there is intermittent loading, is as bad as a short-center drive because of the flapping of the loose strand of the

belt. Under these conditions a short-center drive is preferable, either of the open type or the automatic idler installation which will be discussed later. This is illustrated by Fig. 3, the dotted lines showing the short-center installations.

Experience has proven that an arc of contact of not less than 155 deg. on the driving pulley should always be maintained if possible; when it falls below this, excessive belt tension is necessary. There are a number of rules for determining proper center distances, but the table on page 3 is based on plant experience and will allow the proper arc of contact and an elastic belt.

This table is based on motor drives and crossover installations from headshafts to countershafts, jackshafts and lineshafts, where pulleys of reasonable diameter are employed. Belt drives from engine flywheels and capacities above 250 hp. are few in present-day practice; therefore, the center distances of such drives are to a great extent dependent upon operating conditions and the obvious fact that long centers are necessary.

Vertical Drives—A belt drive in a vertical position and without means of take-up is troublesome, because the belt is constantly falling away from the lower pulley, whether it be the driver or driven. This sagging is due to the natural stretch of the belt under load. Where a non-adjustable vertical drive must be employed use as short a center distance as possible.

A tension idler or take-up facilities overcome the difficulties of vertical installations and should always be employed if possible. An angle of 15 deg. from the vertical will partially avoid vertical-drive trouble be-

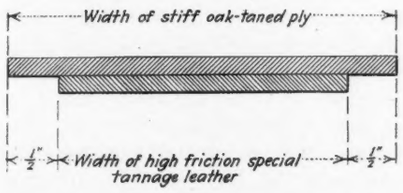

FIG. 10—CONSTRUCTION of a special type of leather belt for use on cone drives.

* * * *

cause the belt will sag against the pulley. To install belting excessively tight on vertical drives is bad practice because it shortens the life of both belt and bearings.

Crossed-Belt Drives — Belting is crossed in practice to reverse the direction of rotation and to increase the arc of contact.

With a crossed belt there should not be a high ratio between the pulleys because the cross then occurs close to the smaller pulley and may cause a condition which is disastrous to power delivery and the life of the belt. The best results are obtained when the pulleys are of almost the same size; the cross then occurs midway between them.

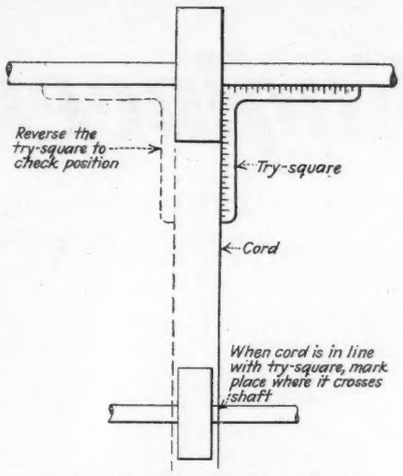
Reverse the try-square to check position
Try-square
Cord
When cord is in line with try-square, mark place where it crosses shaft

FIG. 11—ALIGNMENT of pulleys can easily be checked as shown here. Place a try-square against one of the shafts and the edge of the pulley, stretch a cord along the edge of the try-square, at right angles to the shaft, and mark the point where the cord crosses the other shaft. Repeat the check on the other side of the pulley, as shown. The edge of the small pulley should be equidistant on both sides from the point where the cord crosses the shaft.

* * * *

Belting over 8 in. wide should not be crossed, because the large area of contact of the belt upon itself causes loss of power and excessive wear. When crossing a belt careful attention must be paid to the method of joining employed. A poor joint or a projecting metallic fastener will cause premature destruction of the belt.

Quarter-Twist Belting Drives—A quarter-twist, sometimes called quarter-turn drive, is employed for transmitting power by belting at right angles, either vertically or horizontally. It is a power-wasting, troublesome installation and should never be employed unless absolutely necessary. For the best results, leather should be employed, because a drive of this character necessitates that the belt be especially constructed for it and this is more easily accomplished with leather.

Fig. 4 illustrates a typical, vertical quarter-twist installation. A very simple but positive rule for installing such drives is: *The center of the face of the loose side of the driver must line with the center of the face of the tight side of the driven.*

Fig. 5 shows a semi-quarter-twist installation, where the shafting is not absolutely at right angles. This is a troublesome installation and should be avoided wherever possible.

An idler will eliminate some of the difficulties, on quarter-twist installations that are intermittently loaded and where a specially-constructed leather belt is not available. Fig. 6 illustrates the installation of a fixed idler on a right-angled, quarter-twist drive. The idler should be placed about as shown and the drive installed as a regular quarter-twist installation.

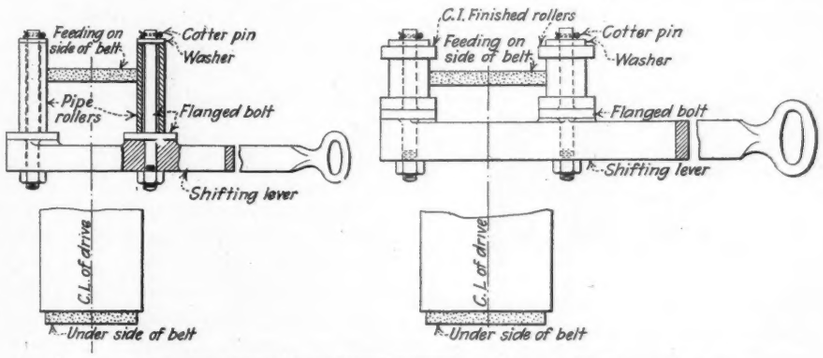

FIG. 12—PROPERLY-CONSTRUCTED shifters will do much to prevent damage to belts that are frequently shifted. Diagram *A* shows the use of pipe sleeve rollers on the shifting forks. In diagram *B* grooved or flanged cast-iron rollers are used.

* * * * * * * *

Guide-Pulley Installations — Circumstances at times make it necessary to transmit power by belting from horizontal to vertical shafting, which means transmitting power up over or around a corner. This is accomplished by the aid of guide or "mule" pulleys, as they are ordinarily termed, operating on independent spindles or shafts. At best, this type of drive is difficult to maintain owing to the excessive transverse stresses on the belting. Flanged mule pulleys are sometimes employed to keep the belt on the pulleys, but unless the proper type of belting is employed, rapid curling of the edge results.

(*Please turn to page 10*)

Plant Engineer's Forum

Conducted by F. M. GIBSON, *Consulting Editor*
Plant Engineer at American Sugar Refining Company

IN A PREVIOUS issue an effort was made to show the great number of branches of engineering an industrial engineer must practice. They, more than any group that I know of, will appreciate the remarks of Dr. Davis, president of Stevens Institute, in his inaugural address. He stated that, "Stevens proposes to confine itself to the job of building foundations; to give its budding engineers only that broad, sane platform of general engineering principles on which practical experience may later build whatever towers of specialism, circumstances and developed personality may make wise." Of course, this statement was intended to apply to the specialized engineer who erects only one large tower upon the platform but it applies equally well to the

industrial engineer who must erect, possibly, two or three major towers as well as a variety of smaller towers.

Educators of engineering now recognize the economics of engineering and are including it in the curriculum but they have one more step to complete the whole.

The course in economics will aid in determining an economic solution and there, engineering education ends, although there is another step to take. To be of any value the solution must be put into effect and that requires approval and funds from the management. Many a good proposition has been discarded because the engineer used poor judgment in presenting his recommendation. Too often, dependence is placed upon general statements without supporting facts to make them convincing; conditions that are perfectly obvious to the engineer but not to the laymen are limited rather than explained, sufficient care is not given to the preparation of the report so that it is not clear and does not carry any of the enthusiasm of the author.

Sometimes the error is made in presenting a proposition when it is well known that there are no funds available for the work. This usually results in the proposal being laid to one side and when reconsidered at a later date it does not carry the same appeal that a new subject does. There are times when the proposal involves too great an expenditure at one time and the engineer fails to provide a plan whereby the work can be done in successive steps over a period of time.

It may not be possible to teach the budding engineer these things but it can be shown to him that those are some of the things that he will have to learn. Call it executive ability, management, salesmanship or whatever you wish, it is something that the faculty should explain to the student.

* * * *

There is one engineer in the East who is ever on the hunt for ideas to save money or increase production. He has worked up more schemes than he can ever secure money to carry out. A rough estimate of the cost and saving of each scheme is made and all of the schemes are listed by departments. A copy of this list is given to the plant manager. It is very useful because it gives him a better understanding of the plant and its possibilities. It gives him some assurance, when investing money in

improvements, that there is no other way of investing the money to secure greater returns. There are many engineers who are not in accord with this method, claiming that the larger a proposal is, the less likely it is to receive favorable consideration. It would be very interesting, if some of the readers of the Forum would send in their comments on this subject.

During a period of construction when steam systems were unbalanced, Jack Nelson had this experience. The noise of steam escaping from the relief valve on the roof reverberated from the side of a tall building in the neighborhood in magnified volume and the populace in the nearby tenements could not sleep. Fortunately, there was a very high brick stack near the relief valve; the steam was exhausted into it, and the complaint of the neighborhood ceased.

But that is not all of the story. The stack was of standard type of con-

struction built by one of the reputable chimney companies but the condensate appeared on the outside of the stack in spots about five feet apart. This makes me wonder if our chimneys are as tight as we think they are.

* * * *

It gives one satisfaction to see the number of articles in engineering magazines of recent date that have been written by industrial engineers. It is comparatively easy to secure papers from consulting engineers and equipment manufacturers but it requires a tremendous effort to secure them from industrial engineers. It seems to be the result of an exaggerated inferiority complex rather than lack of ability or subject matter. There is no other class of engineers in a better position to judge the effect of design of equipment or processes upon operation, and the publishing of their opinions and experiences would not only be a benefit to the profession generally but would greatly add to the prestige of the industrial engineer.

Management could well afford to relieve him of details to collect data and study his department and its possibilities for greater economy.

High-Frequency Power

Simplifies the Motor Application Problem

By JOHN P. PETROWSKY

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Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

THE NECESSITY for higher frequencies in the application and use of industrial electrical power is the result of our present-day incessant striving and efforts in industry to increase production and reduce manufacturing costs by the development of improved high-speed machinery and the introduction of all kinds of labor saving tools and devices, the general recognition of the advantages of direct-connected motor drives on high-speed machine tools, and the application of the squirrel-cage induction motor to these high-speed drives.

The wood working, the metal working and the textile industries are at present the principal users of these high-speed machines and tools. However, development work along existing and new lines is going on unceasingly and with increasing momentum, thus, not only extending the old applications, but also opening up entirely new fields of application. Therefore, examples of these high-speed applications may be mentioned such as shapers, molders, spindle carvers, joiners, routers and tenoners in the wood-working industry, grinders and buffers in the metal-working industry, in addition to other portable tools such as drills, reamers, screw drivers, nut setters, grinders and buffers.

The use of the higher frequencies is not confined to motor applications alone, but extends to many other recent innovations in our modern industrial life. Quite recently 180-cycle frequency has been applied successfully on a considerable scale in electrical welding operations. In the textile field high-speed motors are extensively used in spinning rayon silk. Other applications are too numerous to mention.

It is well known that electrical apparatus receives very little expert attention and care in the majority of industrial plants. Therefore, simplicity and reliability are the most important factors to be considered in selecting the proper electrical equipment for such applications. The induction frequency changer fulfills these conditions admirably due to the fact that it is as simple and reliable a piece of apparatus as the ordinary slip-ring induction motor and requires no more skilled supervision and attendance than the squirrel-cage induction motors using this high frequency power.

Squirrel-cage induction motors, due to their ruggedness and simplicity, which means freedom from motor troubles, low maintenance costs and increased production, are being used almost universally in these high-speed industrial applications. However, the speed of an induction motor depends on the frequency of the power supply, and there are very definite limits as to the maximum speed obtainable at any given frequency. For instance, 3,600 r.p.m. is the maximum speed obtainable at the standard commercial frequency of 60 cycles, and for speeds higher than this, means of raising the frequency of the power supply must be resorted to. Fig. 1 shows the relation between induction motor no-load or synchronous speed, and the frequency of the power supply for motors of different number of poles. The full-load speeds are a few per cent, usually less than five per cent, lower than the synchronous speeds.

The range of motor speeds required by the different applications is very large. The wood-working industry employs motor speeds up to approximately 9,000 r.p.m., necessitating fre-

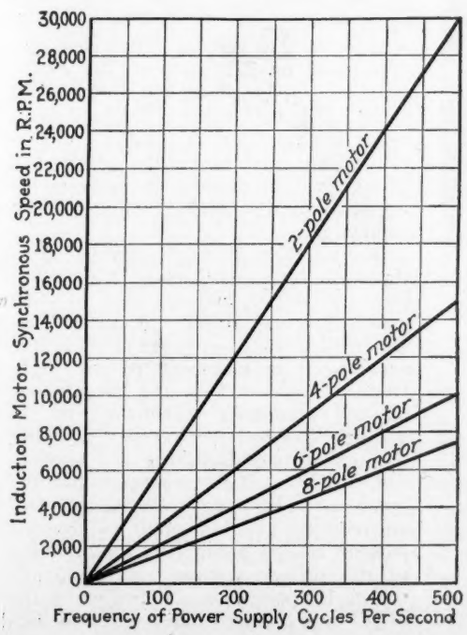


FIG. 1 — RELATION between induction motor synchronous speed and the power supply frequency for motors having different numbers of poles. (Left).

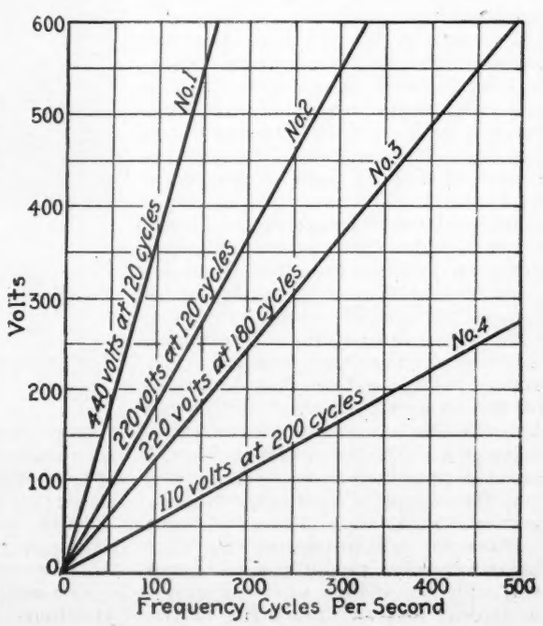


FIG. 2 — STANDARD frequencies and voltages above 60 cycles. The lines *1, 2, 3* and *4* represent established standard voltages in the different frequency ranges. (Right).

quencies up to 150 cycles. The most commonly used frequencies, outside of the standard 60-cycle frequency, in this industry are 75, 80, 90, 100 and 120 cycles. In the metal working industry considerably higher motor speeds are required. The high-speed internal grinders which are extensively used in this industry generally require motor speeds between 10,000 and 20,000 r.p.m., with 30,000 r.p.m. as the probable upper limit, thus necessitating frequencies up to 500 cycles. On the other hand,

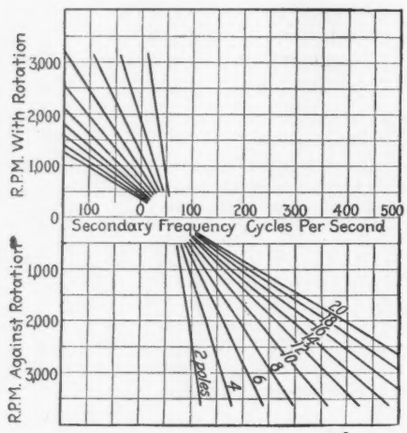


FIG. 3 — FREQUENCIES obtainable with induction frequency changers of different number of poles. Curves are based on 60-cycle primary frequency.

* * * *

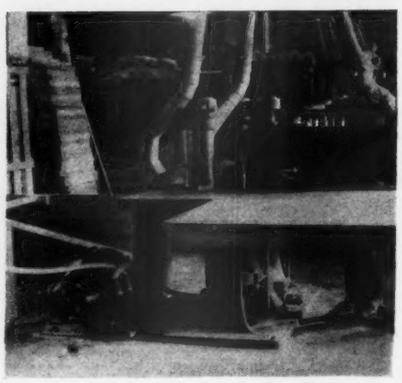
180-cycle frequency is extensively used for portable tools. In the textile industry motor speeds between 5,000 and 8,000 r.p.m. are in use, or are being considered for the near future, thus requiring approximately the same frequency range as the wood working industry.

From this brief discussion of the motor speeds above the 60-cycle speed range, which are used in the various industries, we can see that the high-frequency industrial power field covers a very wide range of frequencies extending from approximately 75 cycles up to 500 cycles. In providing the induction frequency changers necessary to cover this frequency range and in order to keep the number of frequency changer ratings within reasonable and practical limits, a line of machines developed for a given frequency is used, which may be used also for a number of other frequencies. So, for example, a line of frequency changers designed for changing the frequency from 60 to 120 cycles is used also for 100, 90, 80 and 75 cycles, as well as for various intermediate frequencies. Of course, the high-frequency secondary voltage and the output capacity of the frequency changer will change also with the change of the secondary frequency. The secondary voltage is directly proportional to the frequency and the output is approximately proportional to it.

Since the voltage and output of an induction motor vary in a similar manner with the change of frequency, it is evident that an installation consisting of constant-speed, squirrel-cage induction motors, in conjunction with an induction frequency changer can be used advantageously for obtaining variable speed of considerable range by simply arranging a variable speed drive for the frequency changer. Such means of obtaining variable motor speeds are sometimes found desirable and of advantage on machine tools and in the textile industry, as well as for various testing and experimental outfits.

The voltages used in the high-frequency industrial power field range from about 35 volts up to 600 volts, the selection of the voltage, of course, depending chiefly upon the requirements of the different classes of applications. Certain applications due to some peculiar operating conditions encountered may require the use of extremely low voltages, whereas others may require the use of relatively high voltages. The rayon silk industry may be mentioned as an example of such a low-voltage application, where voltages as low as 38 volts at 90 cycles are used in order to guard the operator from receiving dangerous electric shocks, as these places are usually very damp and permeated with acids.

Such low voltages, however, are not desirable for general use, and should be avoided wherever possible on account of the large percentage voltage drop in the conductors from the generator to the motors, and the greatly increased size of these conductors, as well as the increased difficulty in collecting the large high-frequency currents from the rotor of the frequency changer through the sliprings. So, for example, for a given current density and length of the distribution cables, the voltage drop due to resistance, reactance and skin effect, expressed as percentage of the rated normal voltage, would be more than six times greater in a 38-volt system than in a 220-volt system, although the amount of copper used in the 38-volt system is 5.7 times greater.



HIGH-SPEED moulder motors in the wood-working industry (Grinnell Bros. Co., Holly, Mich.) are supplied with 120-cycle power by the 10-kw., 80-per cent power factor, 60- to 120-cycle, 1,800-r.p.m. belted, induction frequency changer shown at the lower left.

* * * *

The majority of high-frequency applications use voltages between 110 and 440 volts. At 120 cycles the established standard voltages are 220 and 440 volts. These voltages have been selected so that 110-volt and 220-volt, 60-cycle motors could be used at this higher frequency. In the wood-working industry—the principal user of the 120-cycle frequency range — this is found to be a very desirable practice as it simplifies the motor application problems.

At 180 cycles, 220 volts is the established standard voltage. Portable tools are the principal users of the 180-cycle power so 220 volts has been adapted as being the most suitable voltage for this application. Portable tools require a voltage that is not high enough to endanger the lives of workmen using these tools, yet it should be sufficiently high to prevent objectionable voltage drop in the current carrying leads from the generator to the tools without making these leads too bulky; and 220

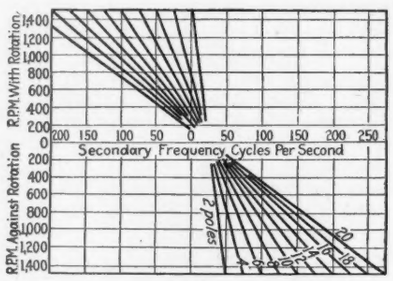


FIG. 4 — FREQUENCIES obtainable with induction frequency changers of different number of poles. Curves are based on 25-cycle primary frequency.

* * * *

volts probably satisfies these two conflicting conditions better than any other voltage.

At 200 cycles, 110 volts has been used to some extent and may be considered also as an established standard voltage. In Fig. *2* the lines *1, 2, 3* and *4* represent the above mentioned established standard voltages in the different frequency ranges. Line *1* is based on 440 volts at 120 cycles, line *2* is based on 220 volts at 120 cycles, line *3* is based on 220 volts at 180 cycles and line *4* is based on 110 volts at 200 cycles. In a frequency changer or a motor designed for one of these different voltage and frequency series, the voltage will vary along the corresponding straight line with a change in the frequency.

Besides these voltages established as standards by general usage, there have been introduced, and are used to some extent, various other voltages. This undesirable situation is the result of the very rapid development of the high-frequency power field and the absence of any standards established by an authoritative body. However, in order to simplify manufacturing and application problems, it is important that the number of different voltages and frequencies be kept as small as possible without unduly hampering the selection of the proper voltage and frequency for each application. Recognizing the evils and undesirable consequences

that would result from a promiscuous and indiscriminate introduction of new voltages, the National Electrical Manufacturers Association has taken this matter up for consideration with the view of heading off undesirable new voltages and establishing certain voltage standards for this new and rapidly developing high-frequency power field. Fig. 2 has been taken from the Committee's report appointed to investigate and make suitable recommendations in this matter.

An induction frequency changer, as far as its mechanical construction is concerned, is essentially an induction motor of the phase-wound rotor or slip-ring type. Certain modifications and changes, however, are necessary in the electrical design to meet the different magnetic and electrical conditions when operating as a frequency changer.

The underlying theory of operation

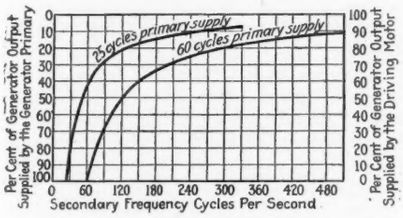

Per Cent of Generator Output Supplied by the Generator Primary
25 cycles primary supply
60 cycles primary supply
Per Cent of Generator Output Supplied by the Driving Motor
0 10 20 30 40 50 60 70 80 90 100
100 90 80 70 60 50 40 30 20 10 0
0 60 120 180 240 300 360 420 480
Secondary Frequency Cycles Per Second

FIG. 5—CURVES showing the percentages of the secondary output supplied electrically by the primary through transformer action and mechanically through the shaft by driving the motor at various secondary frequencies and at primary frequencies of 25 and 60 cycles.

* * * *

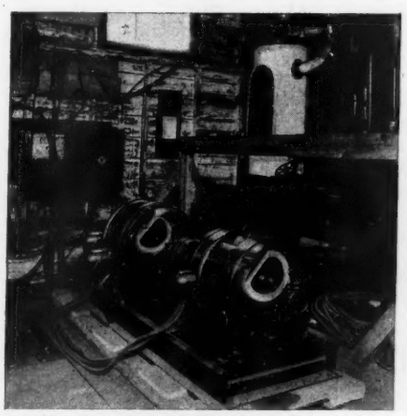
of the induction frequency changer, briefly is as follows: Polyphase alternating currents flowing in the primary winding of a polyphase induction motor produce a gliding or rotating magnetic field form which has the same effect on the secondary winding as the mechanically-rotated magnetic field poles of an ordinary a.c. generator, that is, of inducing alternating electromotive forces in the secondary winding. The frequency of these induced electromotive forces depends on the relative speed of the rotating primary field with respect to the secondary winding. At standstill the secondary frequency is the same as the primary frequency, and at synchronous rotor speed in the direction of the primary field rotation—assuming that the rotor is the secondary—it is zero. If the rotor is driven by external mechanical means against the direction of rotation of the primary field, then the secondary frequency is higher than the impressed primary frequeney. In general, the secondary frequency is equal to $[(P \times S) \div 120] +$ primary frequency.

Where P = the number of poles of the frequency changer and
S = the rotor speed in r.p.m.

The plus sign applied when the rotor is driven against the direction of its rotation, and the minus sign when it is rotating in the direction of its rotation. Fig. 3 shows the frequencies obtainable with frequency changers of different number of poles with 60-cycle primary frequency, and at speeds within the range of direct-connected m.g. units driven by a.c. motors of either the induction or synchronous type. Fig. 4 gives similar data for 25-cycle primary frequency.

A very wide range of frequencies can be obtained theoretically as shown in Figs. 3 and 4, from a given frequency changer simply by driving it at the required speed in the proper direction of rotation. In actual practice, however, there are several limiting features which have to be very carefully considered and which make the useful frequency range much narrower. The maximum permissible safe machine speeds set the upper frequency limits, whereas ventilation and permissible temperature rise set the lower frequency limits. Any frequency within the practicable range can be obtained on belted machines, but on coupled, motor-generator sets driven by induction or synchronous motors only certain frequencies are obtainable.

An important point which should be considered in connection with selecting frequencies and frequency changers is the fact that high-speed machines generally give better electrical performance characteristics than the slow-speed machines. In order to obtain good voltage regulation and high power factor, a frequency changer designed for a given frequency should have as small a number of poles as it is practicable to use from the mechanical standpint. Of course, higher speeds permit smaller and more compact machines, which is another point in favor



ONE GETS an idea from this picture of the hard and unfavorable service conditions under which industrial frequency changers have to operate. This 50-kw. 80-per cent power factor, 60- to 180-cycle induction frequency changer m.g. set installed and wired up in a temporary manner is supplying power for various portable tools in a Bethlethem Ship Building Corporation plant.

* * * *

of the higher-speed machine, and is especially desirable in portable and semi-portable sets. Such sets are often used in portable tool and other applications.

At standstill the induction frequency changer acts like an ordinary transformer, that is, power can be obtained from the secondary at the primary frequency, and, in addition to the secondary power output, the primary supplies all the losses. But when the rotor is driven by mechanical means against its rotation, only a fraction of the total secondary output is supplied by the primary through transformer action and the rest is supplied mechanically through the rotor shaft.

The two curves in Fig. 5 give the percentages of the secondary output

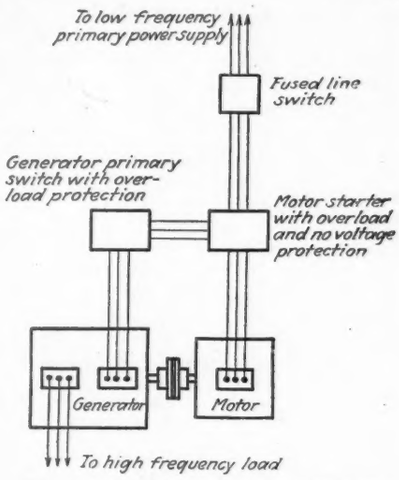

To low frequency primary power supply
Fused line switch
Generator primary switch with overload protection
Motor starter with overload and no voltage protection
Generator
Motor
To high frequency load

FIG. 6—SCHEMATIC wiring diagram of induction frequency changer m.g. set with squirrel-cage motor driving unit.

* * * *

supplied electrically by the primary through transformer action and mechanically through the shaft by the driving motor at various secondary frequencies, and at primary frequencies of 25 and 60 cycles. As the ratio of the secondary frequency to the primary frequency increases, the percentage of the secondary output supplied by the primary through transformer action decreases, while the percentage supplied mechanically increases. For example, at 120-cycle secondary frequency and 60-cycle primary frequency, 50 per cent of the secondary output is supplied by the primary through transformer action and 50 per cent is supplied mechanically by the driving motor, whereas at 25-cycle primary frequency less than 21 per cent is supplied by the primary electrically and more than 79 per cent is supplied mechanically by the driving motor.

In the earlier days of the induction frequency changer application in industry, it was generally belted to the nearest available source of power supply, but at present the self-contained, directly-coupled m.g. set with the generator and the driving motor mounted on a common bed-plate as shown in an accompanying illustration, is much more in favor due to the fact that such a combination makes the complete frequency changer outfits very compact and extremely easy and simple to set up and to operate. The driving unit usually is a squirrel-cage motor, although occasionally a synchronous motor is used to obtain power factor correction.

A great majority of the industrial applications require only one definite frequency and, therefore, a single-speed squirrel-cage motor fully satisfies the requirements as the driving motor. However, in the few cases where more than one frequency is required, a two-speed, or even a four-speed squirrel-cage motor can be used, thus giving either two or four different frequencies. Such an arrangement does not introduce any undesirable complications in the operation, since by means of a simple, pole-changing switch the multi-speed induction motor can be changed over readily from one speed to another.

In practically all industrial frequency changer applications the load consists of two-pole squirrel-cage motors which have a high power factor, so that the resultant power factor on the supply system from induction frequency changer load compares favorably with the average power factor conditions on industrial power circuits which carry induction motor loads. Since frequency changers are generally driven by squirrel-cage motors, either belted or directly coupled as m.g. units, which are connected to the same source of power supply as the frequency changer primary, the actual power factor on the power supply system from induction frequency changer load is the resultant power factor of the frequency changer primary power factor and the driving motor power factor.

Good voltage regulation is very important in an induction frequency changer due to the fact that there are no other means of adjusting the secondary voltage except by changing the voltage on the primary side. But this is impractical in the great majority of frequency changer applications. Therefore, a frequency changer must maintain a satisfactory voltage under the load conditions for which it has been designed. To allow a safe margin for fluctuations in the primary voltage and for voltage drop in the conductors from the frequency changer to its load, the voltage regulation usually does not exceed 15 per cent.

Sometimes induction frequency changers are used to supply power for only one or two high-speed squirrel cage motors in connection with individual machine-tool drives. In such cases, the capacity of the frequency changer must be considerably larger than the rating of the connected motor in order to properly start and bring the motor up to speed. This is due to the fact that such motors take a large starting current at low power factor, which has a very bad effect on the frequency changer voltage regulation. It is always more economical from the standpoint of the initial installation costs to use a frequency changer in connection with a group of motors, wherever such an arrangement can be made. Such an arrangement generally gives better operating efficiency as well. Where a frequency changer is used to supply power to a group of motors having intermittent duty cycles, the capacity of the frequency changer need be only a fraction of the installed motor capacity.

The control required is very simple. For a belted generator unit the only control required is a disconnecting switch with overload protection in the primary circuit. This switch can be either of the manual or magnetic type. The control for an m.g. set driven by a squirrel-cage motor usually consists of: a main disconnecting switch, the motor starter with overload and no-voltage protection, and the generator primary switch with overload protection. Such an arrangement is shown in Fig. 6. Preferably, the control should be of the magnetic type with the generator switch interconnected with the motor starter.

Also, induction frequency changers are employed for changing from a higher to a lower frequency. As can be seen from Figs. 3 and 4, frequencies below the primary supply frequency can be obtained by rotating the rotor in the direction of its rotation, that is, in the direction in which it would rotate as an induction motor. In order to hold the speed at the required value, a squirred-cage motor wound for the correct speed generally is coupled to the frequency changer. The primary of the squirrel-cage motor is connected either to the primary power supply line, or to the secondary of the frequency changer, depending on which combination gives the desired results in the most satisfactory manner.

Since the frequency changer supplies both electrical and mechanical power when lowering the frequency, it is evident that for a given secondary power output the size of the machine is considerably larger and the electrical performance characteristics poorer than in the case of raising the frequency. For these reasons induction frequency changers are seldom used when the primary frequency has to be changed to a lower value.

From Figs. 3 and 4, it is seen that both a lower and a higher secondary frequency than the primary supply frequency can be obtained by driving the rotor of an induction frequency changer above its synchronous speed in the direction of its rotation. Such a scheme, however, is never used in practice due to the fact that it is very uneconomical as the driving motor would have to be very large, since it has to supply not only the whole of the secondary load, but also the power that is pumped back into the line by the primary of the frequency changer.

Transmission of Power

(Continued from page 5)

The best results are obtained when the belting is not over 1½-in. in width; belting over 6 in. in width should never be employed. The thickness of the belt should conform to the pulley diameters. Fig. 7 shows a typical installation of belting power around a corner. Fig. 8 shows the use of mule pulleys to connect two parallel shafts not in the same plane. This type of drive is frequently used for various machine tools.

Cone Pulley Drives — Taper cone drives are employed when variation in speed is required and unless a properly designed belt is employed, such drives are a constant source of trouble. When cone pulleys of extreme taper are employed, even narrow belting will take the form shown in Fig. 9*A*, when in motion. The edge of the belt is constantly changing from the high side of one pulley to the low side of the other, and is thrown out of line. Under these conditions the belt does not run smoothly and is quickly damaged by the shifter fork. If the belt is crossed, as shown in Fig. 9*B*, the long edge is always on the high side of the pulleys.

The constant shifting generally required on cone-pulley installations has led to the development of a special cone-driving leather belt, whose construction is shown in Fig. 10. It consists of one ply of high-friction leather running against the cone face, and another ply of stiff oak-tanned leather approximately 1 in. wider than the friction ply. The narrow ply gives a friction surface that minimizes slippage and wear, whereas the outer ply withstands the rubbing of the shifter forks and adds strength.

Alignment of Shafting and Pulleys— This is one of the most important factors in the economical transmission of power by shafting and belting. For efficient operation, all driving mechanisms must be absolutely in line.

In belting installations, the center lines of the crowns of the pulleys should always line with each other, and parallel shafting should be absolutely parallel. A belt will always run to the high side of the pulleys.

A simple yet practical method for aligning two pulleys is illustrated in Fig. 11.

Shifting of Belting — Belting that is shifted from a tight to a loose pulley and back is subjected to considerable wear on its edges. The transverse strain or crumpling action increases in proportion to the width and thickness of the belt; therefore, there is a limit to the width employed on shifting drives. Single leather or four-ply fabric should not be employed over 4-in. wide; double, leather or six-ply fabric not over 8 in. wide. Special care should be given to the condition of shifter forks, etc. It is well to use pipe-sleeve rollers, as shown in Fig. 12, or grooved, cast-iron rollers mounted on the forks, as shown in Fig. 12*B*. Numerous belts are permanently ruined by rough and crude shifting appliances.

AROUND THE WORKS

Special Cable Extension for Industrial Electric Locomotives

VARIOUS manufacturing plants using overhead line or third rail electric locomotives for yard switching find it necessary to do switching operations inside the buildings where overhead cranes are in operation. In the open hearth steel plant this is especially true as the empty mould cars are shifted into the one end of the building and alongside the pouring platform. After the moulds have been cast full of steel the ingot train is then pushed or pulled out of the other end of the open hearth building to the stripper crane and thence to the soaking pits and the blooming mill.

Inside the open hearth building it is almost impossible to maintain a trolley line or third rail in operation on account of various unavoidable accidents; such as, spilled metal, slag, overhead cranes carrying metal, derailed mould cars, etc., any one of which may put the trolley or third rail system out of commission.

A form of trolley extension was devised by the writer, which would permit a locomotive to operate at either end of the building. This outfit consists of a series D.C. motor "X" floating across the 230 volt line with resistance in series to ground and mechanically connected to the cable reel so that the motor would keep tension on the flexible cable line feeding the locomotive. Number 2/0 extra flexible field lead was used for the feeder and 500 feet were required for each extension.

In the event of a break in this extension cable on account of a heavy ground or other accident the series motor driving the reel in the reverse direction, would drag the cable the entire length of the building at high speed and the loose live end would whip around the drum or reel and cause a heavy ground every revolution. The scheme worked well except for the heavy maintenance expense on this very high grade flexible conductor.

Two laborers were used to operate these locomotives so it was necessary to make the outfit as nearly fool proof as possible. The scheme was changed to operate as follows: The locomotive T enters the building by overhead trolley and must stop at point "Z." The trolley pole is drawn down and the cable "C" is attached at "B" and plugged in at "A." The operator throws a switch inside the cab to position "D" and the ground man pushes the "start" button located on the building column. This closes the shunt operated magnetic switch "E." Switch "F" consists of a current limit lock out contactor. The magnetic tail piece "G" has been replaced with a bar of brass so as to keep the switch in the proper mechanical balance. Now the old series coil "H" has been replaced with a new series coil consisting of as many turns and of as large a cross section as can be accommodated in the given space. The sectional area of these turns must be of sufficient capacity to handle the entire load of the locomotive plus the load of the resistance "L." On the other hand enough turns must be used in series coil "H" to keep the switch closed when current is flowing through resistor "L" only. It is apparent then that the path of the current is through switch "E," series coil "H," collector ring "J," reel "K" to the locomotive and through a permanent resistance "L" inside the locomotive to the ground. The resistance "L" is so proportioned that the current passing through coil "H" will cause switch "F" to close. Switch "F" closes the circuit on the reel motor "O" and the extension is made taut because of the reverse action of the motor.

Now if an open circuit or broken cable occurs between points "P" and "T," switches "F" and "E" open. The dead cable drops to the ground and no damage is done to cable or other apparatus.

When shifting is finished inside the building the switch inside the cab is thrown to position "V." The trolley pole is raised, the cable is disconnected at "C" and the locomotive is ready for outside work. In connection with the operation of this device, note that the locomotive can move forward or backward or it may stop in any position but under any operating condition the cable reel motor at "X" will tend to reel up and keep the cable taut while if any accident happens to the cable between "P" and "T" the entire device is inoperative and is made safe.

Baltimore, Md. R. K. HOKE.

THIS SECTION is especially devoted to short articles describing ideas and practical methods devised to meet particular operating conditions. The items may refer to mechanical details of installation, inspection, testing, wiring, repair, maintenance, replacement, and emergency or unusual installations of equipment tributary to production. Special attention is given to shop or bench tools and short cuts or improved methods of handling work brought into the repair shop. Contributions from our readers are always welcome.

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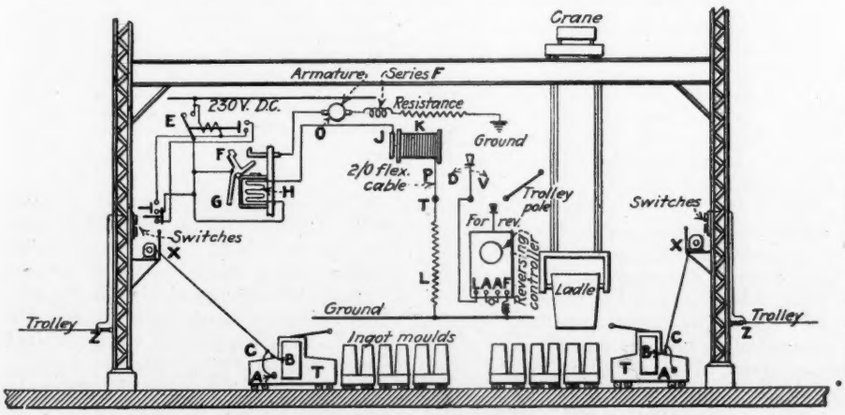


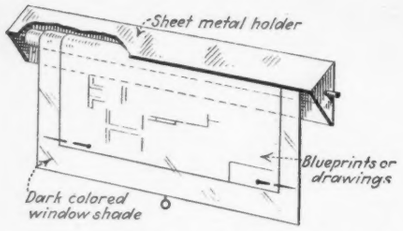
A SPECIAL CABLE EXTENSION for industrial electric locomotives operating in an open hearth building.

Handy Plan Holder for the Machine Shop

BLUE prints in the machine shop fade after several days use, unless they are carefully protected against light, or stored in a desk or drawer. Paper drawings have no place in the shop, but they are however frequently found in use, particularly where work is rushed.

The means adopted in one shop to make plans accessible and yet afford them the required protection, is of more than passing interest, and it is a well thought out plan which will appeal to any shop foreman. This device shown in the attached sketch, consists of a sheet metal holder and a large dark colored window shade.

One of these holders is placed on the wall adjacent to each machine. Blue prints are pinned to the shade cloth, with large pins, and the area of the shade is said to permit the holding of several drawings or the related parts of the material being produced.



PLAN HOLDER for the Machine Shop. The device consists of a protecting cover and a roller shade to which is pinned the plans or drawings. The roller shade is of dark color which prevents the plans from fading, and the cover protects the whole from dust and dirt.

* * * *

The dark shades prevent fading, the plan is kept free from grease and the smudging incident to handling. It is easily referred to and saves time. The protecting holder keeps off dust and dirt.

Washington, D. C. G. A. LUERS.

Keeping the Oil in the Bearings

ENGINEERS and electricians will agree that a large percentage of electric motor failures are due to bearing troubles. These, of course, originate from any one of several causes, but by far the most important is the self-evident fact of insufficient lubrication. In a number of mills where conditions are necessarily far from ideal, considerable trouble is caused by vibration making the oil rise in the overflow cups provided by the motor manufacturer.

Where this condition exists, it is frequently found that the oil has syphoned out of the well leaving the bearings high and dry. We have found this to occur many times, not only due to vibration but to the too zealous attention of an oiler, as well as to his carelessness in pouring too great a quantity of oil into the well. Once the oil starts to syphon there is nothing to stop it until the supply is exhausted, even though the cap of the overflow is constructed to fit somewhat above the cup, supposedly to prevent just such an occurrence.

After several such happenings and their attendant serious shut-downs, we arrived at the scheme of attaching in the place of the troublesome oil overflow cups, a simple standard oil sight glass. This is nothing more than a simple gage glass with cork gasket which can be purchased for a nominal sum at any hardware dealer or lubrication device manufacturer's establishment. The proper oil level can easily be marked on the glass and the inspector has no alibi for putting in too much or too little oil, the level always being visible.

We attached these gage glasses by taking out the oil overflow cups and putting in their stead two street elbows to lower the glass the proper amount or in some cases where the overflow was sufficiently high, merely by screwing in a pipe nipple of the correct size, then a coupling and finally the gage glass.

New York, N. Y. B. F. C.

Reducing the Light Bill

DUE to the fact that production could not be distributed evenly over all the equipment in the plant, a manufacturer had to run a night shift in some departments. The factory was equipped with an overhead lighting system which gave ample illumination for general shop purposes, each bay being on a separate circuit.

The big bulbs, however, did not furnish light enough for accurate measurement nor were the conduits of the system serving the individual lamp at each machine large enough for the installation of circuits heavy enough to meet new conditions. It was decided to rewire the shop and put the local light for each machine on an individual circuit, with its control switch in the timekeeper's office. These switches were arranged on a large panel, corresponding with the layout of the shop, each unit having a plate bearing the machine designation. The aisles were lettered "A", "B" and "C", starting from the east wall, and the machines on each aisle were numbered beginning at the north wall. A big planer in the middle of the shop bore the symbol "F-7," and the switch controlling that circuit was likewise marked.

Each man coming in for the night shift or overtime work, gets his card from the clock rack, and pushes the button lighting his machine. The closing of the circuit is indicated by a pilot light on the panel. As each man pushes the switch, he also hangs one of his numbered tool checks on a hook at the side of his switch, to indicate that he is using his light. Once on the job he can turn on such units as he needs with the individual switches at the machine. When he finishes, it is a simple matter for the operator, when ringing out, to snap off the switch for his machine and take off his check.

Previous to the installation of the panel, it was necessary for the night watchman to walk many useless miles to the various machines in turning off the lights left burning by the men in their hurry to get home—a practice which imposed an unfair burden on the watchman, already pressed to his limit to complete his regular rounds of the plant; and which led to several quarrels through lights being turned off by the watchman, while the worker was at the tool room or in the stock bay. After the installation of the panel, the watch, seeing a machine lighted, could easily check up at the time office, and, if the card of the man working on "F-7," for example, was in the "out" rack, as easily cut off the current.

The management computed that the current saving alone on the new wiring system paid for the additional cost of the panel and wiring in its first year, leaving the longer life of the lamps as clear profit. Added to this item was the considerable saving in current through not being obliged to use the overhead light while checking or general work was being carried on in any bay.

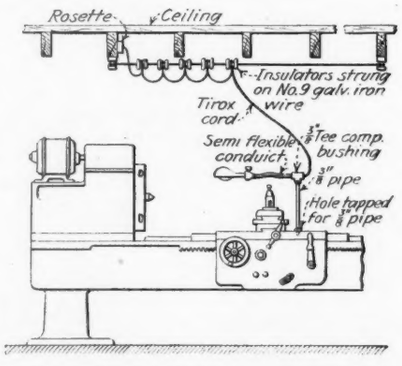
Having the machine lighting circuit dead (except under unusual conditions) left the operators without artificial light during the day for examining bores and the like; a condition gotten around by placing flash lights in the tool room, whence they might be drawn the same as tools, gages, and other plant equipment.

ELTON STERRETT.
Savannah, Ga.

An Improved Lathe Lighting Fixture

AN UNUSUALLY long lathe in the plant where the writer is employed, was lighted by means of an ordinary extension cord. The slack in this cord was the cause of considerable trouble and danger, especially when long stock was being worked in the lathe.

The drawing shows the arrangement which made it possible to light the work on any part of the lathe without being bothered by the slack in the extension cord.



THIS INEXPENSIVE arrangement permits a light to be placed directly over the work on any part of a long lathe. The porcelain insulators, sliding on a galvanized wire, keep the slack of the lamp cord out of the way. The lamp itself was made from parts of a discarded fixture.

* * * *

Whenever the tool is moved, the porcelain insulators on the galvanized wire take up the slack. The semi-flexible conduit allows the lamp to be focused in many different positions for the particular piece of work being done. The parts for the lamp itself were obtained from a discarded desk fixture.

CHARLES A. PETERSON.
Chief Electrician,
Cold Spring Granite Company,
Cold Spring, Minn.

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Industrial Engineering's

EQUIPMENT REVIEW

REVIEWED in the following pages are all of the items of equipment that were described in the New Equipment section of *Industrial Engineering* in the twelve issues of 1928. This issue, therefore, furnishes, under one cover, an equipment index and guide of permanent value.

Announcements of equipment as it is placed on the market are made each month as a service to the reader. In this service *Industrial Engineering* thoroughly believes. The editors aim to make the service complete by announcing every piece of equipment within the field of "service to production" as it is made available for purchase, and invite the co-operation of manufacturer and distributor in making available promptly suitable technical descriptions and photographs.

Air Conditioning Equipment

Air Filter, Panel-Type

Staynew Filter Corporation, Rochester, N. Y.

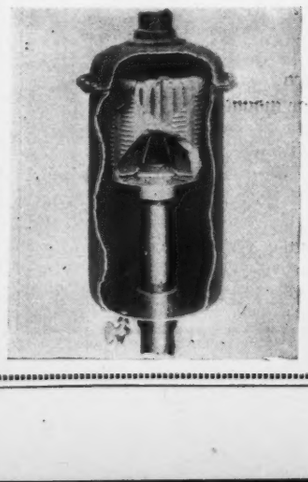
Designed as a unit to handle 800 c.f.m. of air. When more air is required, two or more units are used in parallel. The panels are supported on an angle-iron or an aluminum frame. The cloth, especially suited to give a guaranteed filtering efficiency of 99.9 per cent, is arranged in a series of hollow fins supported on wire mesh. It may be cleaned by means of compressed air or a vacuum cleaner without removing it from the supporting bases.

Air Filter, Pipe-Line

Staynew Filter Corporation, Rochester, N. Y.

The purpose of this air filter is to remove dust, water, oil, rust, scale, and other foreign matter from air passing through pipes.

The filter consists of an aluminum housing inclosed in a pressed-steel housing that will withstand a working pressure of 125 lb. The filter, mounted inside, consists of a self-filter medium formed in pockets over radial wire screen fins grouped about a central outlet. This permits mounting a relatively large area of felt in a compact base, and allows the use of the entire available area of felt with a negligible restriction. The large capacity inserts are designed to pass 250 cu.ft. of free air per minute. They contain 20 sq.ft. of felt within a volume slightly smaller than a cubic foot.

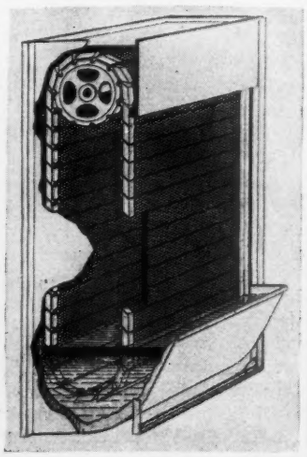


Air Filter, Double-Pass

National Air Filter Co., Chicago, Ill.

In this device the air is filtered twice, and the filtering medium is itself cleaned with oil, thereby eliminating oil entrainment.

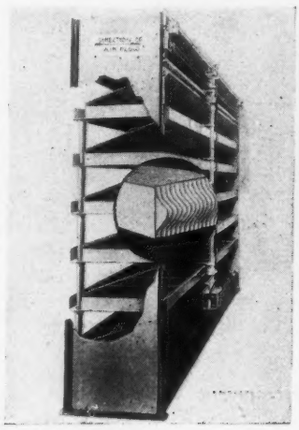
The "Two Pass" filtering medium is of the endless curtain type; with small units of multiple layers of woven copper ribbon and expanded metal passing over a large supporting wheel at the top and through an oil cleaning bath at the bottom. This arrangement presents two walls through which air must pass, and each wall is an efficient filter in itself. The entire curtain is encased in an 18x28-in. sheet metal frame which may be had in various heights, depending upon the opening desired.



Air Filter, Sinuous-Type

Midwest Air Filters, Inc., Bradford, Pa.

The standard characteristics of their Model S-H (sinuous-horizontal) filter, call for a 29x19⅝x3⅛-in. cell having an air capacity of from 3,000 to 3,500 c.f.m., depending upon the conditions.



The maximum resistance through the sinuous filter and through the filter medium is 0.34 in. and 0.25 in. W. G., respectively, with an efficiency of from 96 to 99 per cent. The explanation of the high efficiency of this filter is that the energy used up in accelerating the air flow is not dissipated as in the multi-baffle, uncontrolled air flow filter, but it is retained by application of the venturic principle and transmitted unimpaired to the outer air stream.

The path and final lodgment of any dust particle entering this filter medium can be predetermined with a high degree of accuracy.

Collecting System for Dust and Shavings

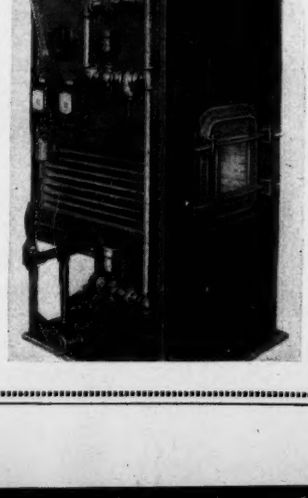
The Kirk & Blum Manufacturing Co., Cincinnati, Ohio.

This "Plenum" dust and shavings collecting system is particularly adapted to the woodworking departments of automobile body and other mass production plants. The main duct is of one size throughout and connections may be made at any point from end to end with equally satisfactory results. There are no mechanical conveyors within the main. The removal of shavings piping with a machine and the reconnection of this piping to the main at a new location is permitted with no sacrifice of efficiency.

Humidifiers, Unit-Type

The Clarage Fan Co., Kalamazoo, Mich.

Types B and I unit humidifiers are self-contained devices for automatically maintaining a predetermined temperature and



degree of humidity in a room, department, or other inclosed space.

By means of these units the air in a compartment or room may be warmed and moistened, or cooled and dehumidified. In the latter case the unit is connected to a cold water supply. The Type I humidifier, which is intended for general industrial application, does not require a system of sheet-metal ducts; it discharges conditioned air directly into the atmosphere by means of a positive, centrifugal-type fan, which is designed with a self-limiting horsepower characteristic. This feature eliminates the possibility of overload on the driving motor.

Battery Chargers and Accessories

Battery Charger, Constant Potential, 8-Hour

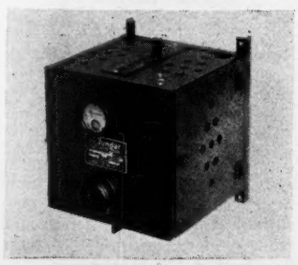
Hobart Brothers Co., Troy, Ohio

These chargers are made in four new models rated at 150, 200, 250, and 300 amp. Each unit consists of an m.g. set of unit-type construction. Ball bearings are featured and all models embody a non-reversing, voltage-regulator winding grid. The 150-amp. charger is a single-commutator type with a capacity of 20 batteries. The motor is rated at ¾ to 1¼ hp. It can be furnished for use on single, two- or three-phase, a.c. or d.c. service. The daily capacity of the 200-, 250- and 300-amp. chargers is 25, 30 and 35 batteries, respectively.

Battery Charger

General Electric Co., Schenectady, N. Y.

The features of this charger include increased capacity and charging rate, greater efficiency,



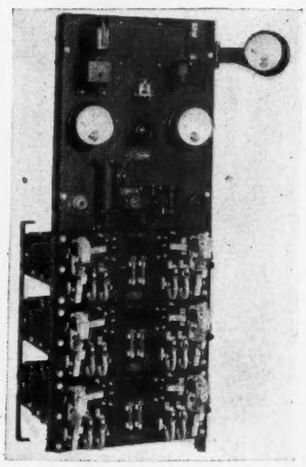
and several improvements in design and equipment.

It weighs 29 lb., and has a charging capacity of six three-cell batteries, or their equivalent, at 6 amp. The ammeter for this unit is contained in a Bakelite case and has been redesigned so that it is now easier to read. A tumbler switch, which controls both alternating and direct-current circuits, is provided. The power consumption of this charger is approximately 400 watts at full load.

Charging Panel

General Electric Co., Schenectady, N. Y.

This control panel was designed for charging six vehicle batteries, each of the 42-cell, 13-plate type, and for use in conjunction with an m.g. set consisting of a 27-kw. 110-volt generator driven by a 40-hp. 550-volt, three-phase, 60-cycle motor.



In addition to a magnetic starter for the motor, the panel provides overload protection for the generator, restarting of the set and resumption of charging after line failure and full automatic shutdown after completion of the charging of the batteries.

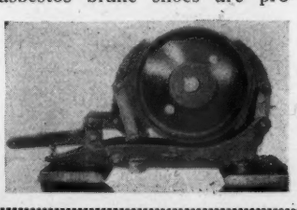
Brakes

Brake, Lever-Operated

The Electric Controller and Manufacturing Co., 2700 East 79th St., Cleveland, Ohio.

This brake is a modification of the E. C. & M. Type W. B. electrically-operated brake; and practically all wearing parts are interchangeable with parts of the electrically-operated brake.

It is of the shoe type, and is intended for the bridge drive of electric traveling cranes, lift bridges, electric hoists, and other applications requiring foot-operated or hand-lever operated brakes. Unusually thick molded asbestos brake shoes are provided, requiring renewal only after very long periods of service in this connection.

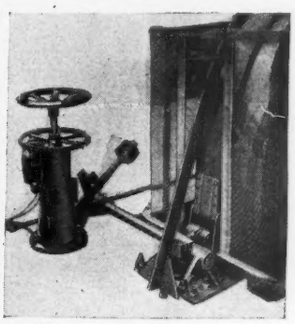


Brake, Super-Synchronous Motor

General Electric Co., Schenectady, N. Y.

Manual braking of the rotating stator is eliminated by the use of this automatic brake whose mechanism consists of an upright standard that supports a vertical shaft, the lower part of which is threaded. When revolved it transmits motion through a trunnion block to a series of levers attached to the brake band. The driving motor for the brake is mounted on the side of the standard. A wheel is mounted on the end of the shaft so that hand operation may be employed.

When the brake is being released the trunnion block travels upward, and is stopped by the tripping of a limit switch when sufficient clearance has been obtained. In tightening the brake, the trunnion block moves down on the screw, automatically applying tension to the brake band until the action is stopped by a

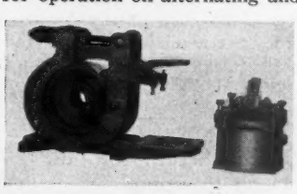


limit switch. By adjusting the weights on the brake lever, it is possible to vary the starting time of the motor from 5 to 40 seconds.

Brakes, Solenoid

General Electric Co., Schenectady, N. Y.

This line bears the designation CR-9516, and includes brakes for operation on alternating and



direct current. It involves in its construction, the use of a spring-setting device—a new feature for a.c. application. These brakes are especially designed for severe service in connection with mill, crane and hoist motors.

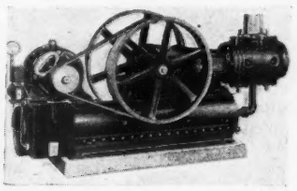
Smooth operation is possible when making quick stops in either direction of rotation. The brake mechanism is held in the off position by a coil and plunger. When power is applied to the motor, the coil is energized and the brake is released. When the power is shut off, the spring-setting device forces the mechanism into closed or braking position. Both a.c. and d.c. brakes use the same brake mechanism and frame; the solenoids being interchangeable.

Compressors Pumps and Accessories

Compressor, Single-Stage

Pennsylvania Pump and Compressor Co., Easton, Pa.

A semi-portable single-stage, double-acting, belt-driven air compressor completely equipped with a motor, a starter, a mul-



tiple-belt drive, an air receiver, an air filter an automatic start and a stop control, which is intended for use in industrial plants and other places where the demands for air are comparatively limited.

The piston displacement is 65 cu.ft. of free air. The automatic pressure control operates between 85 and 125 lb. per sq.in. The dimensions of the unit are: length, 6 ft. 6 in., and width, 2 ft. 4 in., weight 1,380 pounds.

Unloader, Compressor

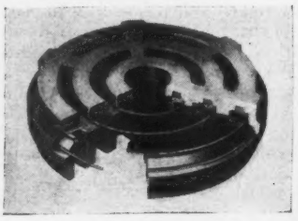
Chicago Pneumatic Tool Co., 60 East 44th St., New York, N. Y.

A differential unloader with the trade name Simplate, for use with Chicago Pneumatic compressors. The valve is a single plate of stainless steel ground to a flat surface. The diameter is ground to fit the cap with a very small clearance and the edge is rounded to prevent sticking as a result of cocking on the seat. The manufacturer states that the device operates with a 5-lb. clearance range between unloading and loading; that is, if the unloader is set to operate at 100 lb., the reloading pressure is 5 lb. lower.

Valves, Air Compressor

Pennsylvania Pump and Compressor Co., Easton, Pa.

This valve features an air-cushioned pocket in the guard.



As the valve opens, and instead of striking the guard, the disks enter this air pocket where the air trapped, provides a cushion which prevents the valve from striking the metal of the guard.

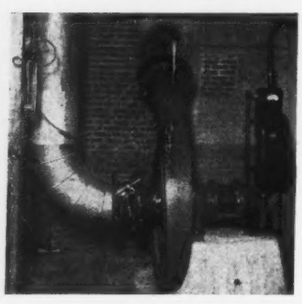
The valve assembly is held together by means of a retaining ring which engages the valve guard and seat. There are no bolts, screws or nuts used in the construction, thus eliminating the possibility of any parts becoming loose and falling into the cylinder to do damage to the compressor.

Blower, Cupola

General Electric Co., Schenectady, N. Y.

This cupola blower is a single-stage, centrifugal compressor, used to automatically insure the supply of a constant weight of air to the cupola irrespective of the atmospheric conditions and the resistance through the cupola.

Constant-speed motors are used, except where d.c. motors are required. The weight of air flowing into the cupola is controlled by opening or closing the blast gate, which can be done either automatically or by



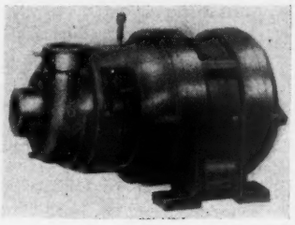
hand. A meter indicates the volume of air flowing for standard conditions and by making slight adjustments as needed the meter reading can be kept constant.

Pumping Unit, Centrifugal

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

This combined centrifugal pump and motor unit, known as Type SSU, is close-coupled by fastening the pump impeller to one end of the motor shaft and bolting the pump casing to a special integrally cast extension of the motor end housings. This eliminates a baseplate, coupling and pump bearings and precludes the possibility of misalignment between the pump and the motor.

These pumps are built in 1¼-, 1½-, 2- and 2½-in. sizes and can be used with 1-, 1½-, 2-, 3-, 5-

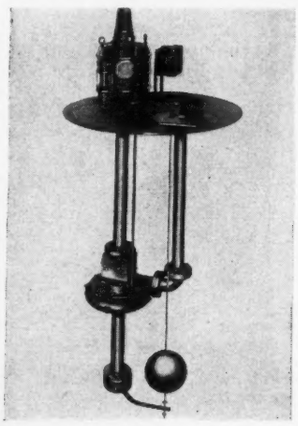


and 7½-hp. motors. The capacities handled range from 25 to 200 g.p.m. against heads of from 50 to 100 feet.

Pump, Sump

The American Well Works, 110 N. Broadway, Aurora, Ill.

This Type M.M.D. sump pump differs from other motor-driven pumps in that it employs a hollow-shaft motor in place of the solid-shaft type. This makes



possible a simple, compact pump.

Its shaft extends up through the motor shaft, hence both motor and pump use the same thrust bearing, which is mounted in the upper end of the driving motor.

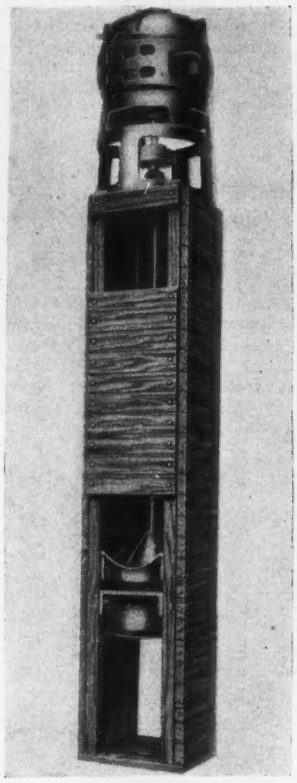
All units are furnished complete with float-control switch, oiling device and motor, and they are available for all standard settings up to 17 ft. in either single or duplex units.

Pump, Screw, for Low Head Pumping

Fairbanks, Morse and Co., 900 So. Wabash Ave., Chicago, Ill.

Designed principally for irrigation and drainage service, this "Everglades" screw pump can be used for any type of pumping where the head is not over 8 ft., and where a low installation cost is desired.

It is a vertical machine, consisting of cast-iron spiders



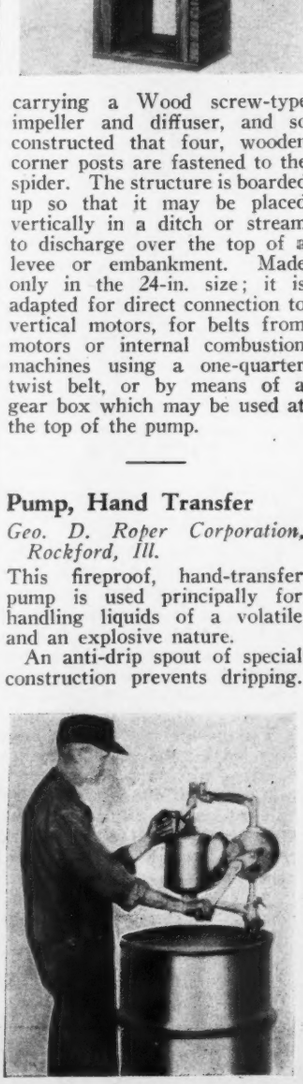
carrying a Wood screw-type impeller and diffuser, and so constructed that four, wooden corner posts are fastened to the spider. The structure is boarded up so that it may be placed vertically in a ditch or stream to discharge over the top of a levee or embankment. Made only in the 24-in. size; it is adapted for direct connection to vertical motors, for belts from motors or internal combustion machines using a one-quarter twist belt, or by means of a gear box which may be used at the top of the pump.

Pump, Hand Transfer

Geo. D. Roper Corporation, Rockford, Ill.

This fireproof, hand-transfer pump is used principally for handling liquids of a volatile and an explosive nature.

An anti-drip spout of special construction prevents dripping.

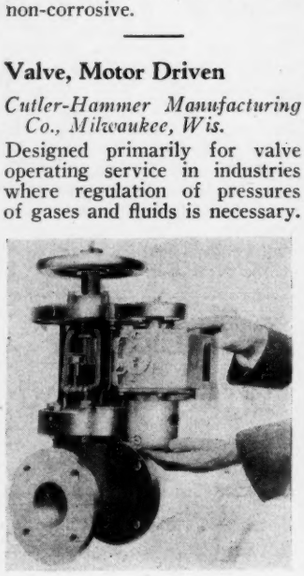


A "Seal-o-matic" check valve immediately stops the discharge of liquid from the spout when the operator stops turning the pump handle. It is made of special grade aluminum and it is non-static, non-ferrous and non-corrosive.

Valve, Motor Driven

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

Designed primarily for valve operating service in industries where regulation of pressures of gases and fluids is necessary.



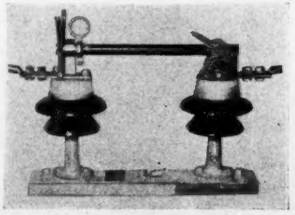
This operating unit has a torque rating of 15 lb. ft. and is so small that it can be held in one hand. It can be operated automatically by means of float switches, temperature-controlling devices, pressure regulators or pushbuttons.

Control Equipment

Cutout, Fusible, High-Voltage

General Electric Co., Schenectady, N. Y.

This combined fuse and disconnecting switch, for vertical mounting and, known as the Type EF-1 is available for volt-

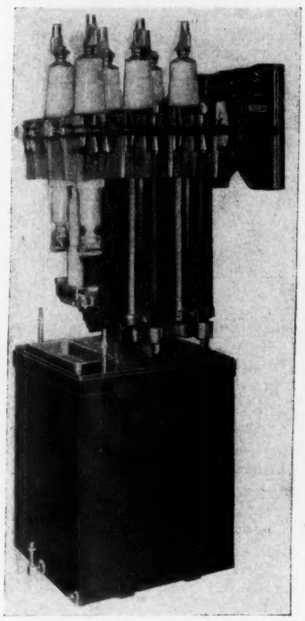


ages of 7,500 to 73,000 volts and in current ratings from that suitable for use with a potential transformer, up to 100 amp. The high-voltage fuse used consists of a treated-fibre tube with a metal ferrule at each end. At the top of the tube a short fuse link is connected in series with a flexible copper cable held in tension by a compressed spring at the bottom of the tube. It is assembled on cemented-cap and pin-type insulators.

Circuit-Breaker, Oil

Condit Electrical Manufacturing Corporation, Boston, Mass.

This oil circuit-breaker, known as the Type D-131 has a high interrupting capacity.



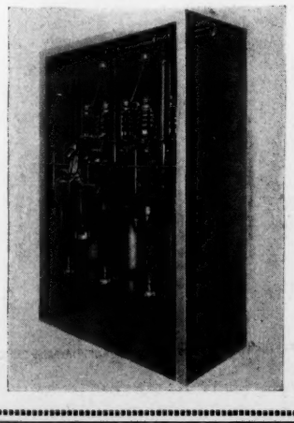
It is of double-tank construction. The inner tanks are supported by heavily-ribbed steel cradles secured by rods suspended on springs set in the frame. The outer, or spill tank fits around the other tank and is supported from the frame by steel rods.

These circuit breakers are built for 400, 600, 800 and 1,200 amp. at 15,000 volts, and 1,600 amp. at 7,500 volts, with an estimated interrupting capacity of 7,000 amp. at 15,000 volts. They are available with two, three and four poles; single-throw, manually or electrically operated.

Circuit Breakers, Heavy-Duty, Oil

General Electric Co., Schenectady, N. Y.

These heavy-duty, oil circuit-breakers, known as the Types FK-330 and FHK-330 are intended for indoor service on



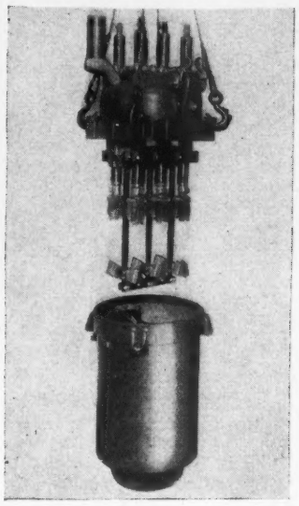
power systems of large capacity. The Type FK-330 breaker has plain break contacts, whereas the Type FHK-330 employs the explosion chamber principle.

The electric operating mechanisms may be of either the solenoid- or the motor-type.

Circuit Breaker, Heavy-Duty Oil

General Electric Co., Schenectady, N. Y.

This circuit breaker, known as the Type FKR-55 has the contacts of all three phases housed in a single tank drawn from heavy sheet steel and fitted with



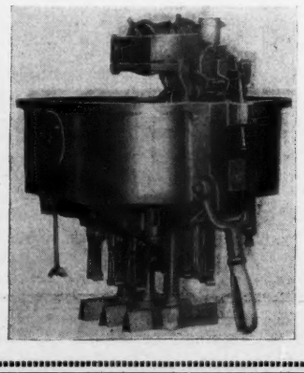
a dome-shaped cover and bottom.

It was especially designed for heavy duty at 7,500 and 15,000 volts; the normal current ratings at these voltages being from 400 to 3,000 amp. The breaker contacts are operated as a unit by means of a mechanism within the tank cover, or in turn, it may be operated by hand, or by a solenoid or motor mechanism.

Circuit Breaker, Oil

Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa.

Each contact of this Type F-10 oil circuit-breaker is divided into two parts; one being the arcing portion, and the other the main current-carrying part.

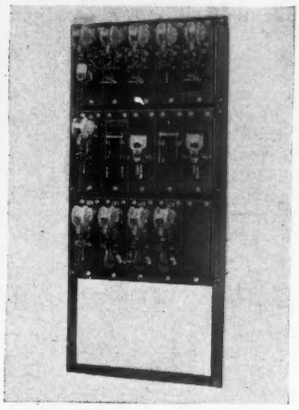


This breaker is furnished in two-, three-, and four-pole combinations; automatic or non-automatic, as desired. The 200- and 300-amp., automatic breakers have interrupting capacities of 5,000 and 7,500 amperes.

Blowouts, Magnetic, For D.C. Mill Contactors

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

This 300-amp., butt-contact type mill contactor, known as Type 142, operating at 200 per cent

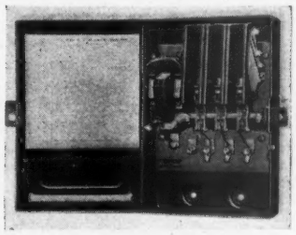


load and alternately making and breaking a 250-volt circuit withstood 263,000 operations for each set of contacts under test. Improvements in the design of magnetic blowouts for d.c. mill contactors are reflected in maintenance and inspection costs.

Contactors, A. C. Magnetic

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

Designed for automatic control of lighting and power circuits, these contractors, two, three, and four-pole types, 20- to 150-



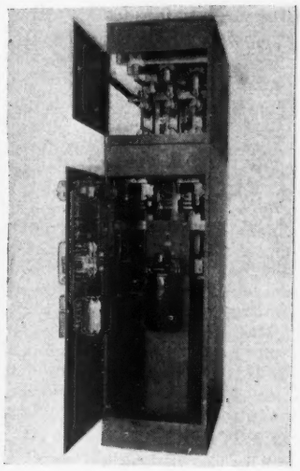
amp. capacity, come mounted in a split inclosing case or on a slate panel for switchboard mounting. Two or three-wire controls can be used.

The large size contactors have the magnet frame supported on a spring plate which absorbs the shock of the magnet on closing.

Feeder Cubicle, Circuit Breaker

General Electric Co., Schenectady, N. Y.

Designed to exclude dust and dirt from the operating parts and insure safety of operation.

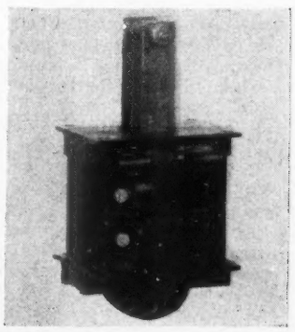


These inclosed cubicles contain a circuit breaker and disconnecting switches, and are operated automatically by relays mounted on the front panel. They are made in standard sizes and in ratings up to 7,500 volts. They may be arranged side by side to form a continuous switchboard.

Solenoids

General Electric Co., Schenectady, N. Y.

These solenoids are made in both a.c. and d.c. types for all frequencies and voltages up to



and including 550 volts. Each size has four types made with the same frame. A pulling solenoid may be changed to a pushing solenoid by adding two standard pusher bars. An a.c. solenoid can be adopted for d.c. operation by changing coils and adding a cut-out switch.

Alarm, Voltage Relay

Iler Electric Service Co. Youngstown, Ohio.

A voltage relay alarm which will cause a bell to ring for two minutes when the power goes off and operate a buzzer for 15 sec. when the power returns. This alarm is operated on 110-volt current but can be supplied for other voltages, or arranged for different time intervals of operation. It consumes 3 watts of power and uses no batteries nor switches.

Time Delay Device

Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa.

This time delay device is designed for use on standard low-voltage release equipment in applications liable to voltage drops of short duration. It is provided with an adjustment which allows the low-voltage release to open from one-half to two and one-half seconds after the voltage drops below the minimum value.

The time adjustment is obtained by varying the position of the fulcrum of the release latch. The dash pot is mounted with the open end down to prevent the entrance of dirt.

Relay, Thermal-Overload

Industrial Controller Co., Milwaukee, Wis.

With Class Number 8532 starter, an across-the-line type thermal overload relay, the push-button station may be located at any point convenient to the operator. The I-C time-element, thermal overload relay is of the melting-alloy type, with a mica-insulated heating element of Nichrome wire or ribbon.

The relays will trip at approximately 10 per cent above their rated current value, or when the temperature of air is 104 deg. F. These units are of the hand-reset type. The horsepower rating can be changed by the insertion of a new thermal unit.

Relay, Signal

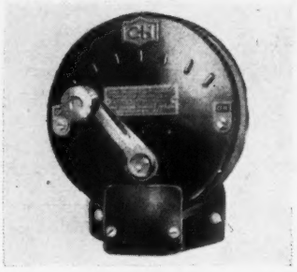
General Electric Co., Schenectady, N. Y.

Designed for application where a small, inexpensive device is needed to actuate a warning signal when power fails or the voltage drops. This CR-2904-F-1 relay is of the solenoid type having a laminated armature composed of three sections, the central leg of which is fastened to a Bakelite operating arm which raises and lowers the contact tips. It is mounted on a 1⅞x2½-in. molded-compound base, and can also be supplied for panel mounting. The relay can be used on either direct or alternating current.

Rheostat, Regulating

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

This rheostat is to control the speed of fractional-horsepower motors driving small blowers,



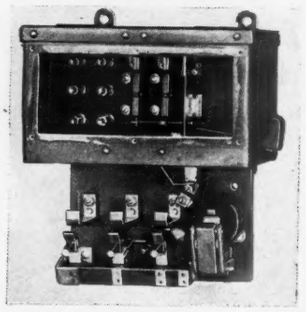
fans, buffers, bookkeeping machines and similar apparatus.

The rheostat is of the circular-plate type, completely inclosed, and is furnished for conduit wiring. It is small to permit mounting directly on the machines or in any out-of-the-way place.

Line Starter, Oil Immersed

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

A modification of the standard type for special applications.

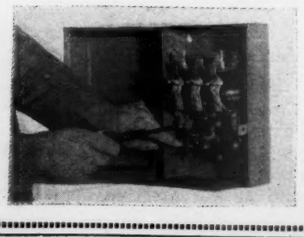


Ventilating openings are dust tight. All operating parts which might cause sparks or arcing are immersed in oil. Another development is a water-tight and a gas-tight push-button station. The upper part of this chamber consists of a rawhide diaphragm through which the operative pressure is transmitted to the interior mechanism.

Starter, Squirrel-Cage, Induction Motor

Westinghouse Electric and Manufacturing Co., E. Pittsburgh, Pa.

A full-voltage starter with a maximum rating of 7½ hp. This line starter is suitable for the

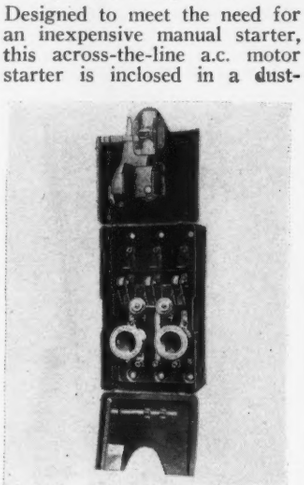


starting and protection of small induction motors driving various types of machines where remote control with complete protection to operator, motor, and machine is desired. It can also be used as a magnetic primary switch for wound-rotor motors within its capacity.

Starter, Manual A. C.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.

Designed to meet the need for an inexpensive manual starter, this across-the-line a.c. motor starter is inclosed in a dust-



proof case and equipped with overload cutouts and cadmium-plated, double-break, roller-type contacts.

The roller-type contacts break the arc in two places, thus giving several times the life of ordinary contacts. The contact rollers turn after each operation to present a new contact surface. Complete motor protection is obtained during both the starting and running periods.

Starter, Motor

Lincoln Electric Co., Cleveland, Ohio

This automatic, induction motor starter has two adjustable features. One adjustment is

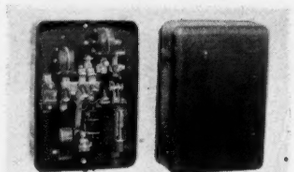
in the starting current and torque that is made by changing the position of the rotor in the regulator, which is index-mounted for ease in setting. The other adjustment is in the current at which the throw-over takes place.

The motor is controlled by the conventional start and stop buttons. After the motor comes to speed and the current has dropped to the desired value, the switch automatically assumes the running position without interrupting the torque of the motor. Protection is afforded by thermo-overload relays and no-voltage release control.

Starter, D. C. Motor

General Electric Co., Schenectady, N. Y.

Designed to provide definite-time acceleration for constant- and adjustable-speed motors,



and divided into five types bearing the designations CR-4065, CR-4066, CR-4166, CR-4068, and CR-4168. Thermal-overload protection is provided by means of single-coil relays having a high thermal capacity to stand high inrush currents. These relays operate only under extreme conditions and serve as a warning to the operator that the motor or wiring requires attention.

Starter, Reversing

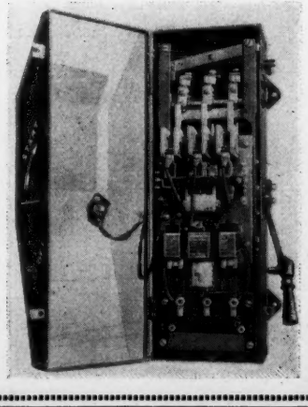
Industrial Controller Co., Milwaukee, Wis.

This reversing starter is rated at 15 amp. for all voltages. It provides remote control, low-voltage and overload-protection, and is arranged for either two- or three-wire service. The Class 8732 starter has two mechanically-interlocked contactors with thermal-overload relays. Class 8712 is of similar construction, but without overload relays. The mechanism is inclosed in a steel cabinet.

Starter, Resisto-transformer, Motor

Allen-Bradley Co., 286 Greenfield Ave., Milwaukee, Wis.

This resisto-transformer starter is a combination of the graphite-compression resistor and the auto-transformer (compensator) type of starter. It pos-

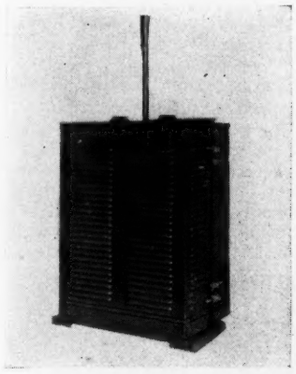


sesses the usual protective features and permits large squirrel-cage motors to be shunted without causing line-voltage jolts. These resistors permit acceleration of the motor from standstill to full speed without opening the line connection to the motor.

Controller, Faceplate

Electric Controller & Manufacturing Co., 2700 East 79th St., Cleveland, Ohio

Ebony asbestos takes the place of slate in the 1928 Dinkey, faceplate controller. The ventilated contacts are raised $\frac{9}{16}$ in. from the surface of the dial and the contact supporting lugs have

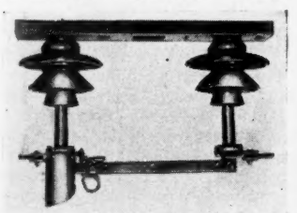


been placed in the front where they may be renewed. This change insures that contact segments will always be of equal height. All controllers, plain, reversing and dynamic, are now fitted with a smooth working center stop, of the notched- and roller-type, making it easy to locate the "off" position. The nickel alloy resistors designed for severe controller duty have ample heat-storage capacity.

Switch, Disconnecting

Railway & Industrial Engineering Co., Greensburg, Pa.

A hook-operated disconnecting switch, known as Type GI-3, designed for 37-kv., 400-amp. service, provided with a large



ring on the combination latch and tryout arrangement so that a pull from any direction will open the blade. It can be made up in the style shown, also as a double-throw or selector switch suitable for mounting in any position. Features emphasized are the interchangeability of parts, self-aligning, full-floating contacts, and truss blades.

Switch, Heater-Type

The Bryant Electric Co., Bridgeport, Conn.

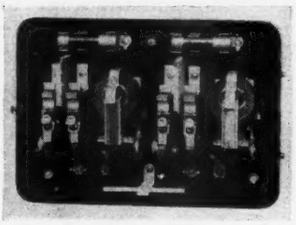
This reversible-rotation, heater-type switch, known as No. 6279, has an indicating handle and a

nickel-silver angle cover with raised polished indications on a japanned black background. It is a three-heat, single-pole, series-parallel switch, with four operating positions; high, medium, low and off. It is rated, 20 amp., at 125 volts or 10 amp., at 250 volts.

Switches, Reversing

General Electric Co., Schenectady, N. Y.

Three switches, known as Types CR-7009-F-1, F-2, and B-10, designed for across-the-line reversing of small motors. The CR-7009-F-1 and F-2 switches are for use with momentary-contact push-button stations, and each consists of two 15-amp., double-pole contactors

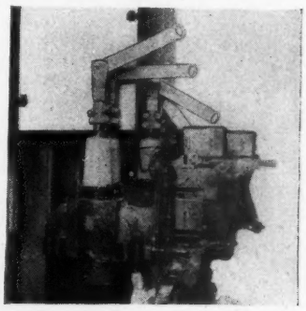


electrically and mechanically interlocked. The F-1 form is without overload relays; the F-2 form has Trumbull overload relays. The B-10 switch consists of two, three-pole, 25-amp. contactors mechanically and electrically interlocked, and is for use with the momentary-contact push-button station.

Switch, Disconnecting

Delta-Star Electric Co., 2400 Block, Fulton St., Chicago, Ill.

This switch is so designed that the blade is mounted directly on an oil circuit-breaker stud and is adjustable to the proper height by means of a sliding sleeve. The floating contact jaws are mounted on a stud passing through a porcelain tube which, in turn, can be clamped to the proper height. The switch is equipped to lock in either open or closed posi-

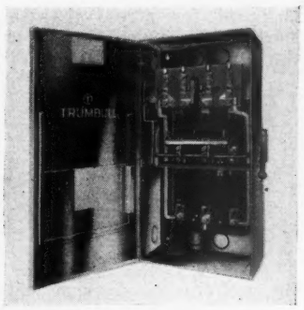


tions. When the oil circuit breaker is to be removed it is only necessary to open the disconnecting switch and withdraw the breaker.

Switch, Inclosed

Trumbull Electric Manufacturing Co., Plainville, Conn.

These polyphase switches, known as Type C are available in sizes ranging from 60 to 400

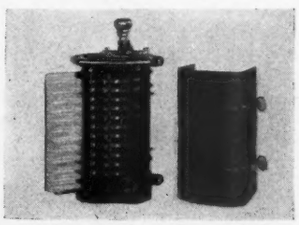


amp. with test connections, and from 60 to 600 amp. without test connections. They are of slate-base construction with the contacts mounted on the top where they can be inspected when the switch is in the "on" position. The test connections are mounted in an accessible position above the jaw posts.

Switches, Primary-Resistance Drum

General Electric Co., Schenectady, N. Y.

These primary-resistance drum switches, known as the Types CR-3200-1250 A and B for



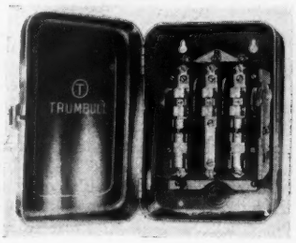
use with squirrel-cage induction motors on small cranes and hoists, are designed for a maximum primary voltage of 550 volts. The maximum rating for two- or three-phase service is 15 hp. Type CR-3200-1250-B switch is intended for hoists where the motor is overhauled in the lowering direction, and Type CR-3200-1250-A switch for hoists where the motor is not overhauled in the lowering direction. The former provides four points hoisting and one point lowering; the latter provides four points forward and four points reversing. These switches may also be used for general-purpose applications.

Switch, Magnetic

Trumbull Electric Manufacturing Co., Plainville, Conn.

Designed for starting a.c. motors of from 1 to 15 hp. These switches are available for 110 to 550-volt, two- and three-phase applications.

High, current-interrupting ca-



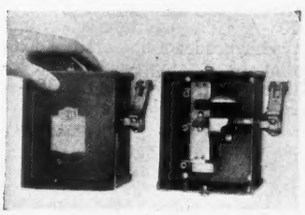
pacity is secured by the use of moving contacts that bridge the gap between the set of stationary contacts, which are self-aligning and self-cleaning.

Overload and under-voltage protection is provided by enclosed thermal relays which control the circuit of the magnet that operates the switch.

Switch, Master

Cutler-Hammer Manufacturing Co., 12th and St. Paul Ave., Milwaukee, Wis.

Designed for splined shaft or shipper-rod operation; as a pilot-circuit control device on



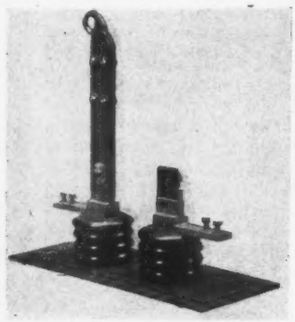
lathes, textile machinery, and other equipment where starting and stopping of a machine is to be governed by a splined shaft, a shipper rod, or similar device. The operating lever can be placed in any one of four operating positions, 90 deg. apart, to suit any installation requirements. In operation, moving the switch to the "on" position starts the motor the same as pressing the "on" button in the ordinary push-button station.

The switch is furnished for three-wire control, but it can also be used for two-wire control on pilot circuits up to 550 volts. A pressed-steel, dust-proof case for conduit wiring is part of the equipment.

Switch, Disconnecting

Delta-Star Electric Co., Chicago, Ill.

These disconnecting switches are of the multi-blade, tongue-types for 7,500- to 37,000-volt, unit-type insulations. The insula-

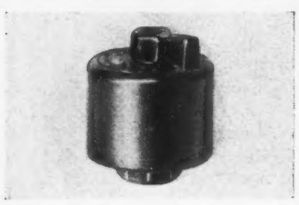


tors are interchangeable with other unit-type disconnecting switches and bus supports. They are made for straight front or back connections. In the back-connected type, the insulators are secured to the steel base by means of a removable clamp, thereby enabling prompt replacement.

Switch, Hand Control

General Electric Co., Schenectady, N. Y.

These small control switches, known as Types SY-103-A and SY-104-A may be mounted in the knockouts of the inclosing



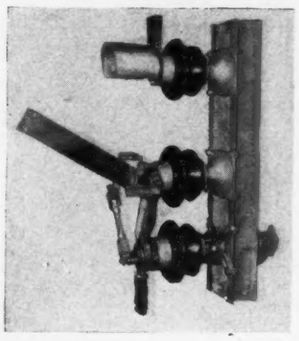
case of any starter. Type SY-103-A is a maintaining-contact type whose action is similar to that of a single-pole, double-throw switch. Type SY-104-A is a two-position, momentary-contact switch provided with start and stop positions.

Both switches are equipped with connecting leads, and have sufficient capacity to handle any magnetic starter up to 75 amp. capacity. These switches can be used with safety on 600-volt circuits.

Switch, Disconnecting

General Electric Co., Schenectady, N. Y.

This switch, known as the Type RP-2, is of the conventional, vertical-break type; the blade being swung between the open and closed positions by a linkage operated by a revolving insulator. Both wedging motion and blade motion are accomplished by a single turning of the operating handle. The switch blade consists of two

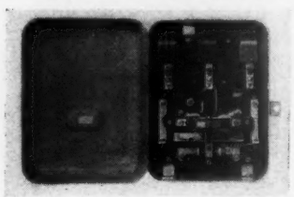


parallel copper bars between which there is a plunger with wedges at each end. The switch is designed for group operation, and in ratings of 2,000, 3,000, and 4,000 amp. and for voltages of 7,500, 15,000 and 25,000.

Switch, Magnetic

Diamond Electrical Manufacturing Co., Los Angeles, Calif.

Designed for across-the-line starting, this switch, known as the Type KXR is adaptable to



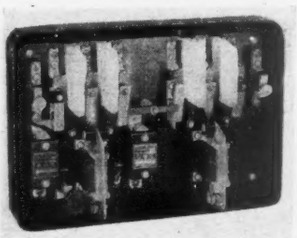
the control of single-, and polyphase, squirrel-cage induction motors. It is available in sizes up to 7½ hp.

All contacts may be moved from the front of the panel without disturbing the wiring in the cabinet. Protection is provided with inverse time limit and thermal overload relays having interchangeable heating elements.

Switch, Across-the-line, Reversing

General Electric Co., Schenectady, N. Y.

A control switch, known as the Type CR-7009-B-12 for reversing small a.c. motors that are



thrown across-the-line. It is of the triple-pole, barrier-type having mechanically, and electrically-interlocked, magnetically-operated contactors and two, hand-reset, thermal-overload relays mounted on a molded base and inclosed in a drawn shell case.

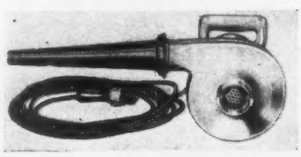
To adapt this switch for use with a motor of a different rating but of the same voltage, it is only necessary to select heaters corresponding to the motor current.

Heating and Ventilating Equipment

Blower, Portable, Electric

Breuer Electric Manufacturing Co., Chicago, Ill.

This portable Type No. 6 blower for removing dust from motors is driven by a ⅓-hp. G.E. motor, which is mounted



on Norma Precision ball bearings. Its weight is 7 lb. Suction attachments and a dust bag may be obtained for converting the blower into an electric suction cleaner.

Combination Cleaner

Ideal Commutator Dresser Co., Sycamore, Ill.

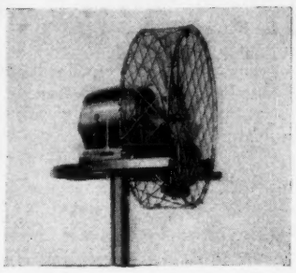
A portable device with extra parts that permit it to be used as a blower or a vacuum cleaner.

Of the two models, the "Super-Giant" is equipped with a ⅓-hp., air-cooled Universal motor suitable for voltages of from 100 to 275. The "Giant" model has the same specifications except for the motor which is rated at 205 watts and which can be supplied for from 32- to 275-volt service.

Fan, Portable, Man-Cooler

Peerless Electric Co., Warren, Ohio

This portable fan, known as the "Man-Cooler" is for use wherever men are working on hot

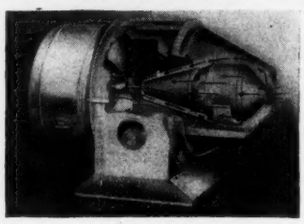


or dusty jobs. A swivel in the fan support allows the fan to be turned so that the air can be directed into any part of the room. The fan is made up of 15 blades guarded by a heavy-gage wire screen and driven by a ¼-hp. ball bearing motor. The machine height is 54 in. overall.

Ventilating Unit

Paasche Air Brush Co., 1909-27 Diversey Parkway, Chicago

The universal mounting and housing designed for this explosion-proof ventilating unit for operation with air finishing booths is adjustable for four mounting positions so that the outlet connection can be made

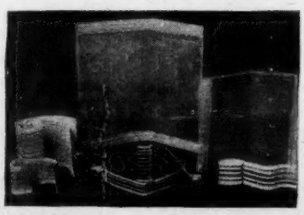


in the most convenient place. The Westinghouse ventilating motor is fully inclosed and mounted on the top, outside of the path of the fumes. Screened air pulled over the motor acts as a cooling agent and prevents any possible explosion. This unit is equipped with a three-blade aluminum fan which handles an unusually large volume of air per hp. The motor can be furnished in four sizes: ¼, ½, 1 and 2 hp., and in both a.c. and d.c. types.

Heater, Woven-Grid

Warren Electric Appliance Co., Inc., Warren, Pa.

This woven-grid heater, known as the "Weaco" Flexible Woven Heater Grid is composed of either iron or Nichrome resistance wire and chemically treated asbestos. The strands of asbestos are woven at right angles to the resistance wire. These grids can be supplied in any size

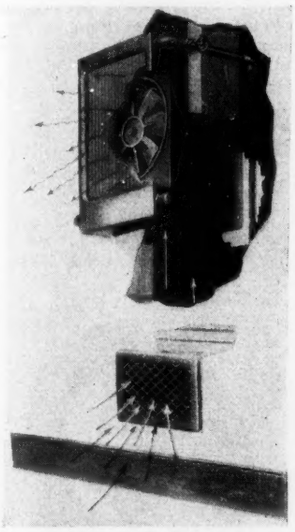


or shape, oblong or square; and for any wattage or voltage for single- or three-heat application. They are intended for low-temperature applications or for appliances such as room or cab heaters, drying or baking ovens, air or water heaters and so on.

Unit Heater

American Blower Corporation, 6000 Russell St., Detroit, Mich.

This No. 2, "Venturafin" unit heater which measures 22¾ in. high, 14⅜ in. wide and 12⅞ in.

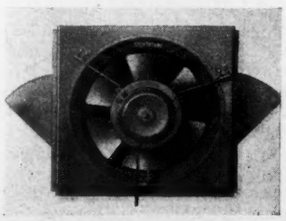


deep is intended for small areas, such as plant offices, small storerooms, garages and small shops, and for places in which the larger units cannot be used on account of their excess heating capacity. Its capacity: 450 to 900 cu.ft. of heated air per minute, represents a heating capacity equal to 125 to 200 sq.ft. of direct radiation. Like the larger unit, it consists of a special steam radiator through which air is blown. The cold air is drawn from a point near the floor.

Unit Heater

B. F. Sturtevant Co., Hyde Park, Boston, Mass.

The heating unit designated as the "high-pressure aerofin" is used in these unit heaters which are designed to withstand steam pressures up to 350 lb. per sq.in. It consists of a copper tubing, having a fin of copper ribbon wound helically around it and soldered to the 1-in.

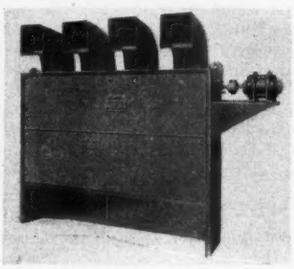


pipe core in order to produce an extended-surface heating section. Air is projected through these units with the design 5 or 6 propeller fan, which is mounted directly on the motor shaft. The motor is supported by a specially designed supporting arm and is located so as to give the minimum of vibration and enable it to deliver air to the heater section while cold before it has expanded beyond the heater coil.

Unit Heater

American Blower Corporation, Detroit, Mich.

These devices, known as the "Sirocco" unit heaters are available in capacities, types and sizes for a wide variety of industrial building heating requirements. Among the principal features are: the rugged mounting for the motor, the accessibility and ease of removal of the fan assembly and heater elements. The heating element is composed of staggered coils of copper fin tubes expanded into one-piece, cast-iron head-



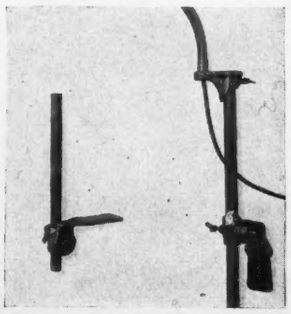
ers. The complete heater unit may be taken out by removing two locking bolts. The motor is mounted on a structural steel saddle attached to the end of the casing.

Lighting Accessories

Fixture, Electric

Multiple-Socket Fixture Co., 374 E. 152nd St., Cleveland, Ohio

This type of fixture, known as Speederlight, No. 200, can be readily adjusted to any angle,

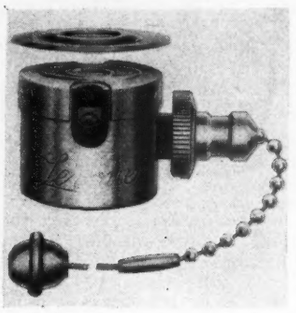


forward or backward. If desired, a special Flexarm bracket can be furnished which will allow the fixture to be swung in an arc of 180 degrees.

Switch, Fixture

McGill Manufacturing Co., Valparaiso, Ind.

This device, known as the Levolier, Cat. No. 61 fixture switch is adaptable for industrial light-



ing. The size of the switch is 1⅜x⅞ in.—and, therefore, suitable for shallow ceiling pans and canopies. The current carrying parts are of heavy section; the make and break is so designed that arcing is minimized.

Aligner, Ball Fixture

Benjamin Electric Manufacturing Co., 120-128 So. Sangamon St., Chicago, Ill.

Where the lighting fixtures are suspended directly from the outlet box, this ball fixture aligner will permit the fixture to hang plumb, even where the slope is as great as 45 deg. The ball-and-socket design protects the fixture against jars and shocks.

Lamp Guard, Insulated

The Ericson Manufacturing Co., Box 2060, Cleveland, Ohio

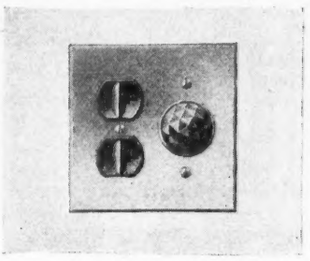
This insulated lamp guard is intended for use around switchboards and other places where safety is essential.

A special rubber band and projecting nibs have been devised, which can be added to the guard so that if it is dragged across concrete floors all the wear will come upon the rubber band or the projecting rubber nibs. The guard consists of a metal frame-work to which the necessary thickness of rubber is added. The rubber is put on in layers. The interior of the reflector shade is coated with aluminum paint.

Receptacle, Pilot-Light

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y.

A combination two-gang, solid-plate duplex receptacle and bull's-eye pilot light in which

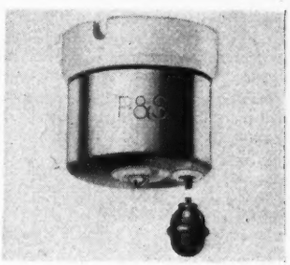


the lamp directly behind the bull's-eye lights when a connection is made to either receptacle.

Switch, Ceiling, Heavy-Duty

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y.

This switch, known as the P&S 2309 has a rating of 10 amp. at 125 volts and is manufactured

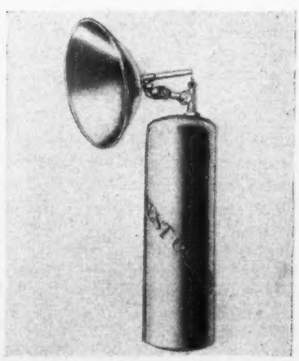


with a solid or slotted base. It is intended for use in controlling units using high-wattage lamps.

Floodlight Attachment

Prest-O-Lite Co., Inc., 30 East 42nd St., New York, N. Y.

Universal adjustment of this floodlight attachment, which is



used with the small tanks of dissolved acetylene is obtained with only one swing joint. By the connection of the attachment, a portable, flood-lighting unit is provided which can be used for illuminating dark places and for facilitating night work of all kinds.

Because of its position near the center line of the tank, the attachment itself can be used as a handle in carrying the entire unit. The 10-in. reflector can be taken off by removing a single knurled nut. The burner is placed at a fixed focal point and requires no adjustment.

Globe Holder, Spring Clamp

Benjamin Electric Manufacturing Co., 120-128 So. Sangamon St., Chicago, Ill.

This spring clamp globe holder replaces the old style screw holder on all Benjamin Glassteel

Diffusers. The clamp arrangement consists of a cadmium-plated wire band gripping over 75 per cent of the globe's neck and terminating in a tension clamp requiring only one motion to release. A single operation of the locking clamp releases the globe.

Lamp, Adjustable

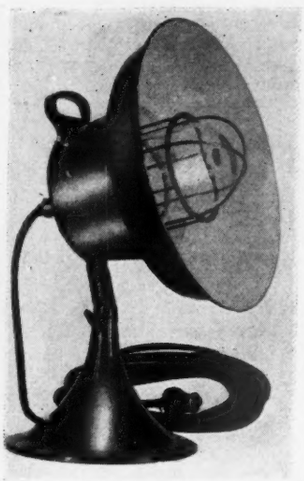
Edward Holt Co., 6911-23 S. Chicago Ave., Chicago, Ill.

The "Edon" lamp, according to the manufacturer, is 100 per cent adjustable and consists of three movable joints attached to a bracket by a swivel. The friction occurs between two phosphor-alloy plates that are connected by a steel farrow, thus assuring a tight joint. Eleven standard types of brackets are available for mounting the lamp, which is finished in black Duco. A push-on swivel shade and an artificial silk lamp-cord with a two-piece attachment plug are standard equipment.

Light, Portable, Electric

Motor City Electric Co., 316 E. Jefferson Ave., Detroit, Mich.

This emergency light equipped with a 150-watt lamp is effective to a width of 100 ft. at 80 ft. from the lamp. Primarily, it is a work light to facilitate indoor and outdoor operations that cannot be easily reached by permanent fixtures,



and where conditions are difficult for the ordinary lighting fixture. This light is water tight and gas proof. The shade is a 13-in. R.L.M. steel reflector. The globe holder is of cast brass threaded for a guard and a globe.

Lighting Unit, High-Bay

Holophane Co., 342 Madison Ave., N. Y.

These high-bay lighting units: No. 691 AL for 750-, 1,000- and 1,500-watt lamps, and No. 681-AL for 300- and 500-watt lamps supersede the old types, Nos. 661-AL and 651-AL.

The holding tripod is made of $\frac{1}{2}$-in. spring steel. The prongs of the tripod holder are clamped between two collars instead of welding as before. A clamping ring is placed over the tripod holder that keeps the prongs 120 deg. apart, thereby automatically maintaining the socket in the center of the reflector. All metal parts are cadmium plated.

Lamp, Vapor-Proof

Daniel Woodhead Co., 15 N. Jefferson St., Chicago, Ill.

In this lamp which is known as the "Vaprotex" unit, the handle and socket holder are in one piece, molded of a rubber compound and threaded to hold the

globe. Added strength is given and the danger of breakage further minimized by the use of a heavy wire guard that clamps both the glass globe and the socket covering. The dust- and vapor-proof globe is made of heat-resistant glass, and the one-piece socket is of molded Bakelite.

A special taped joint completes the sealing so that it can be used under water without danger of a short circuit. The guard is made of heavy wire which is cadmium-plated.

Lighting Unit, High-Mounting

Miller Co., Ivanhoe Division, Cleveland, Ohio

Designed for use in outdoor areas of all kinds, and for use indoors when a large area must be lighted and the unit necessarily mounted 25 ft. or more above the floor level. Lamps of from 300- to 1,500-watt ratings can be used with this equipment.

Reflectors and Holders, Heavy-Duty

The Miller Co., Ivanhoe Division, Cleveland, Ohio

A line of porcelain, enameled-steel reflectors in the R.L.M. dome, shallow-dome, standard-bowl, standard-angle and glass-steel diffuser types with a rolled threaded neck of heavy-gage copper. These collars are securely locked into the forms and will not become loosened or turn in service.

Holders are available for these reflectors in cast aluminum and stamped enameled steel for attachment direct to the outlet box. Suspension types of stamped enameled steel or cast iron are tapped for $\frac{1}{2}$-in. pipe. These holders are supplied with either medium or Mogul porcelain sockets.

Fixture, Lighting Unit

Benjamin Electric Manufacturing Co., 120-128 So. Sangamon St., Chicago, Ill.

In this fixture which was designed for illuminating straight and rounded surfaces from a grazing angle, the powerful flood-light beam is flattened and broadened by means of a special lens, so as to direct a greater part of the light to points farthest from the lighting source, and a correspondingly small portion to the points nearest the reflector.

Light, Portable, Inspection, Hand

Benjamin Electric Manufacturing Co., 120-128 So. Sangamon St., Chicago, Ill.

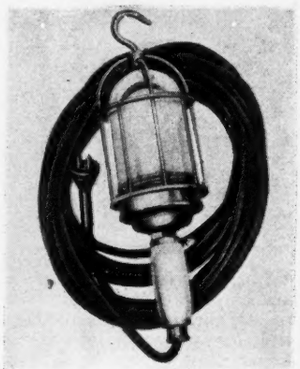
Designed for very close inspection work such as is required in automobile spraying and finishing plants, furniture finishing plants, rug factories, weaving plants and similar locations where the inspection requirements are unusually rigid. When held close to the surface to be illuminated, this light provides a bright spot of illumination of sufficient intensity to show up any imperfection in finish or texture.

The light consists of a heavy-gage aluminum reflector with a highly-polished inside reflecting surface and a sand blasted exterior, producing a satin aluminum finish. A conveniently located thumb switch in the handle automatically breaks the circuit when the thumb is removed, thereby preventing waste of current.

Light, Portable

Motor City Electric Co., 316 W. Jefferson St., Detroit, Michigan

The base of this water-tight, vapor- and gas-proof portable light is made of heavy brass,



and it is provided with a substantial hardwood handle.

The lamp is protected by a glass globe that screws into the base, and is in turn protected by a heavy brass wire guard. It comes equipped with 25 ft. of Belden rubber-covered cord and a Belden all-rubber plug.

Lighting Devices

Holophane Co., 342 Madison Ave., N. Y.

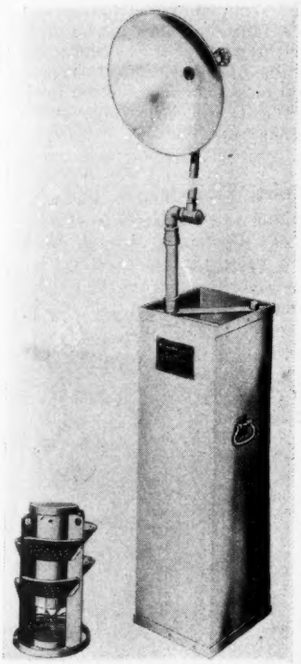
The above company features the following improved devices:—A special water-proof and dust-proof unit, designed to give uniform illumination on relatively wide spacing. The spread of light can be made to vary to suit the conditions by a simple adjustment that can be made while the lamp is burning. This unit is used for the illumination of plant yards. Another unit for mounting over traveling cranes is adjustable for all lamp sizes up to and including the 2,500-watt size. A combined reflector and water-proof globe that is screwed into an aluminum alloy fitting, is used in places where corrosive or explosive fumes or gases make the

use of ordinary lighting equipment dangerous. Another reflector giving a 20-deg. cone of light is available for use in boiler plants where it is necessary to mount the lighting equipment at a considerable height overhead. This reflector is made with an integral dust and socket cover that reflects the light.

Lamp, Carbide

Alexander Milburn Co., Baltimore, Md.

This lamp, according to the manufacturer cannot be overcharged and will operate with

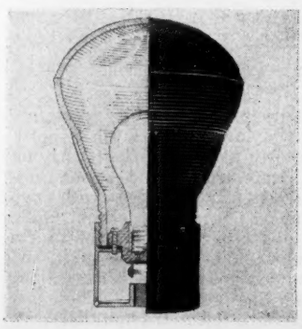


either lump or cake carbide. The center of the carbide container is a cylinder which holds the carbic cakes, and which is equipped with the proper facilities for taking care of the sludge. The outside of this container is filled with conical pockets for ordinary carbide.

Light, Boundary and Obstruction

Holophane Co., 342 Madison Ave., N. Y.

These are special screw-type globes with refracting prisms on

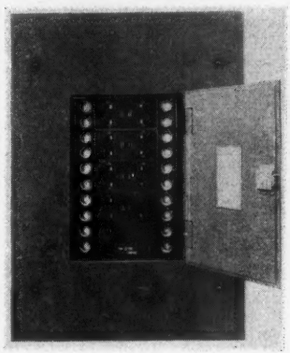


the inside of the globe. No. 02203 is the small size for 15- to 50-watt lamps, and No. 02323 is the large size for 100- and 150-watt, 600- to 1,000-lumen series lamps. Both globes are made in crystal, red, green, or amber glass.

Panelboard, Unit

Trumbull Electric Manufacturing Co., Plainville, Conn.

This panelboard, a safety-type, single-fused unit, known as Type N.T.P., is 4⅜ in. deep and



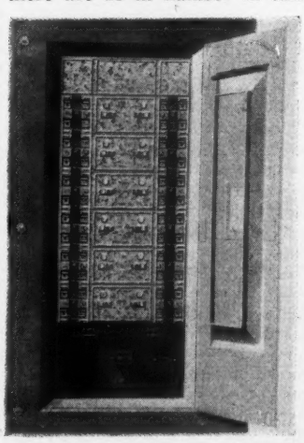
has lugs in the mains, tumbler switches and fuses in the branches, and 4-in. wiring gutters.

A panel of the dead front construction, without requiring the door-within-a-door trim is used. A metal barrier made of four pieces, spot welded together, closes the space between the panel edges and the trim, and is removable as one unit.

Panelboard

Square D Co., Detroit, Mich.

Bakelite in walnut color is used for all molded parts, of which there are 21 in number in this



panelboard. These include adapting units, sectional base, switch covers, switch handles, supporting blocks and blank sections. The circuits also are designated by Bakelite numbering buttons. The tumbler switches, rated 30 amp. at 250 volts are of the heavy-duty type and are easily removable from the front. On the door-in-door safety types no screws or removable parts are exposed when the door is opened. All standard panelboards have 4-in. wiring gutters and fit in a code-gage, 19-in. galvanized steel cabinet.

Sign Illuminator

The Nichols-Lintern Co., 7960 Lorain Ave., Cleveland, Ohio

Two sharp warning signals with a brightly illuminated enameled sign constitutes this No. 165 sign illuminator. The wording of the sign may be changed for the particular application and lenses are obtainable having 2-, 3-, or 4-in. diameters. This two-direction signal, supplements the No. 155 sign illuminator, which is a one-direction signal. The lantern is of cast aluminum and is fitted to take two 10 by 14-in. enameled signs. The lenses used, according to the manufacturer meet American Railway Association signal requirements, and may be fitted with hoods for daylight use.

Lubrication Devices

Lubricator, Force-Feed

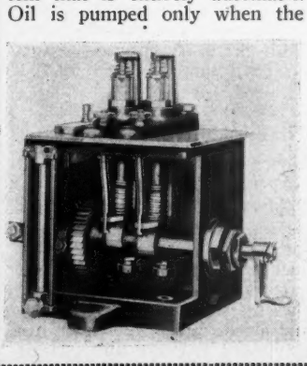
Hills-McCanna Co., 2349 Nelson St., Chicago, Ill.

These lubricators are manufactured in various types of drives, such as belt, reciprocating motion or individual motor, and in capacities dependent upon the nature of the machine to be oiled. Measured quantities of oil are forced to all main head stock and traverse bearings. The lubricator begins pumping oil when the machine is started and likewise stops when the machine is not in operation.

Lubricator, Force-Feed

American Oil Pump & Tank Co., Cincinnati, Ohio

This force-feed lubricator, known as the Model F., consists of an oil storage tank on which is mounted individual pumping units for each oil line, resulting in an oiling system that is entirely automatic. Oil is pumped only when the machinery is in operation and when lubrication is required. When the machinery stops the flow of oil ceases and no lubrication is wasted.



One pumping unit is used for each feed and it is separate and removable from the reservoir. The feed is regulated by adjusting the stroke of the plunger.

A heating chamber is provided in the reservoir, with holes tapped for ⅜-in. standard pipe, so that steam or exhaust gases can be conducted through the reservoir to heat the oil.

Oiler, Multiple-Feed

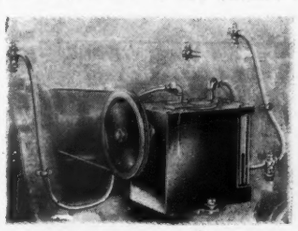
Gits Bros. Manufacturing Co., 1940 So. Kilbourn Ave., Chicago, Ill.

Several worthy design features are embodied in this multiple-lead, wick-feed oiler. The body is of polished aluminum, and standard brass fittings are used throughout. When the reservoir is filled to capacity, the valve stems inside also become filled with oil. When the hand lever on top is raised, oil flows through the valve stems and valves until the lever reaches the top of the valve stem. In this manner each lead drains sufficient oil to flush the corresponding bearing. If certain bearings require more lubrication than others, several wicks may be used in each valve stem, or two or more leads may be connected to these bearings.

Oil Lubricator, Pulsating

Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass.

This automatic circulating system for oil lubrication of machinery, known as the "Blanch-



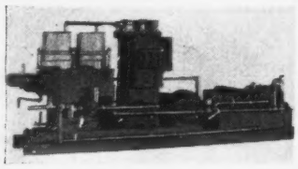
ard Pulsating System," is designed to operate without attention once it has been properly adjusted.

Oil is circulated from a central tank through a single, closed circulating system in which are inserted as many feeders, singly or in gangs, as may be required. The pump, which is contained within the tank, starts and stops with the machine, keeping the oil circulating steadily at a pressure of about 10 lb. for 95 per cent of the cycle. Once every 15 revolutions of the pump the pressure control valve located in the reservoir is closed and remains closed for the remaining 5 per cent of the cycle.

Oil Purifier

Hydroil Corporation, Lebanon, Ind.

In basic principle, this large capacity oil purifying machine is similar to the smaller Hydroil



purifier except that it uses twin bowls in place of the single bowl. Before the oil passes into the centrifugal bowls, it passes through a heater which raises the temperature to the point at which the impurities are most easily separated. After the oil leaves the bowl, it passes through a pressure settling tank where all air is removed. It then passes through a twin filter press, so designed that one-half of the press only is operated at any one time. After the oil has passed through the filter press, it can be passed through a continuous test chamber. The test chamber can be so connected with a relay and by-pass valve that only oil of the desired dielectric strength can pass through to the switch tank.

Seal, Graphite

Joseph Dixon Crucible Co., Jersey City, N. J.

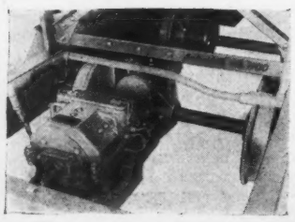
A graphite paste for sealing screw threads, flange and gasket joints of pipe lines carrying hot or cold oils, gasoline, and so on. The seal expands when subjected to heat making leakproof joints that hold tight under all conditions of service. It is insoluble in oils and gasoline.

Materials Handling Equipment

Car Drive

Stephens-Adamson Manufacturing Co., Aurora, Ill.

A standardized method of drive for such industries as the glass, cement, ore smelting, and chemical where self-propelling scale cars are used as a rapid and

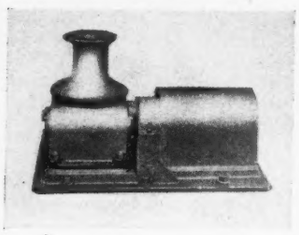


reliable means for collecting batch ingredients. The chassis is equipped with a 6½-hp. mill-type motor having Timken bearings. Three drive sizes have been developed which can be used to drive practically any car.

Car Puller, Capstan-Type

Weller Manufacturing Co., 1820 N. Koster Ave., Chicago, Ill.

Designed to pull in any direction or at any angle, these two upright capstan car pullers designated as the Types C-1 and C-2 will pull from one to three and from three to six cars re-

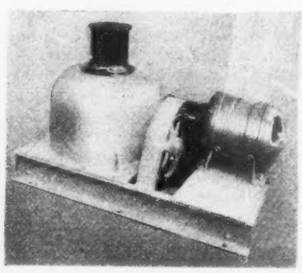


spectively. They are self-contained, electrically-operated units adapted for moving cars in and out of kilns, moving heavy trucks and pulling materials around the plant.

Car Puller, Junior Model

Stephens-Adamson Manufacturing Co., Aurora, Ill.

This vertical, capstan-type car puller, known as the No. 17-J. Junior Model, is mounted on a



rigid steel base made of riveted channel iron. The motor frame is bracket-mounted to a steel plate which is riveted to the channels to form part of the base. The bevel reduction gears are inclosed in the machine housing which affords them excellent protection from abrasive susbtances. The capstan has a speed of 15 r.p.m., and exerts a 2,000-lb. pull.

Chain, Conveyor

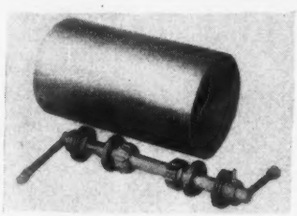
Moore Drop Forging Co., Springfield, Mass.

This chain, made in open and closed link types, was designed for general use on drag lines, bucket or floor conveyors, and monorail installations. It consists of two parts; a center link and a side link. It can be disassembled at every link. High-carbon steel is used, which after drop forging, becomes highly resistant to the corrosive effects of sulphur water, and acid ores.

Carrier, Conveyor Belt

Stephens-Adamson Manufacturing Co., Aurora, Ill.

This carrier, known as the Stephens - Adamson Simplex, consists of three rollers in line,



the troughing roller being mounted at a 20-deg. angle in order to increase the capacity of the belt. The rollers are self-contained units made of steel tubing, and are furnished with drawn-steel end plates. The ends of the rollers are mounted to prevent belt wear. According to the manufacturer, each roller is equipped with two Timken bearings with fittings on each end for high-pressure grease lubrication.

Conveyor, Portable

Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill.

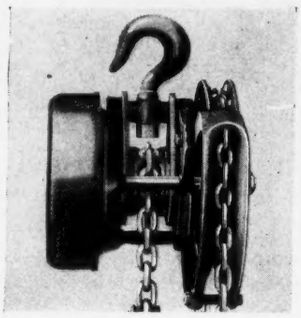
This portable conveyor, known as the "Jax" is designed for handling packages and bags into

or out of cars, and for like service. It consists essentially of an endless rubber belt running over two pulleys mounted 12 or 15 ft. apart on a framework of two heavy pipes tied together at the ends. The conveyor rests on a pair of agricultural-type wheels which are movable to practically any point along the frame. The height of the discharge point of the conveyor can be adjusted by moving the wheels forward or backward along the conveyor frame. The conveyor belt is driven by a motor mounted at the head end on a casting which also serves as a grease-tight housing for the reduction gears.

Hoist, Chain

The Dickerman Hoist Manufacturing Co., Cleveland, Ohio

A spur-geared, ball-bearing, self-contained chain hoist for general material handling purposes. Inclosed hardened and ground balls of high-carbon, chrome-alloy steel, also hardened and



ground chrome-vanadium steel races are used. Felt washers are provided to protect the bearings from abrasive matter and to retain the lubricant. Oil is delivered to the bearings by means of ducts. Steel suspension plates connect the top hook and load wheel bearings which support the load.

Hoist, Electric

Northern Engineering Works, 210 Chene St., Detroit, Mich.

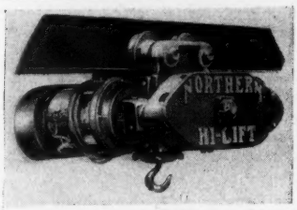
The "Hi-Lift" electric hoist has been developed from the experience in the design and manu-

facture of the Standart-ized electric traveling-crane trolleys. The design, which has been made applicable to monorail use, combines, according to the manufacturer, high hook-lift with ruggedness, and ease of application. Ball-bearing hoist motors can be provided with either single- or variable-speed controllers for either a.c. or d.c. power. The Timken tapered-roller bearings are grease lubricated. Both mechanical load-brakes and motor shoe-brakes are used. The hoist is built in a range of capacities from ½ to 6 tons, inclusive.

Hoist, Trolley

Northern Engineering Works, Detroit, Mich.

Especially adaptable in plants with low ceilings, this hoist, known as the "Hi-Lift," having I-beam trolley and corner collectors, is provided with two brakes; a motor check brake being attached to the end of the hoist motor armature shaft, and a mechanical load brake in the hoisting gear train. These are positive-type, friction-disk rat-



chet brakes of the same construction as the mechanical brake that is now used on other hoists and crane trolleys manufactured by this company. The load hook is capable of being pulled up within 14 in. from the underside of the beam. Two stops are provided; one to prevent the load hook from going up too high, and the other to prevent it from completely unwinding the rope and starting it up on the wrong side of the drum. A flexible coupling is used for the hoist motor.

Crane, Gasoline-Driven, Three-Speed

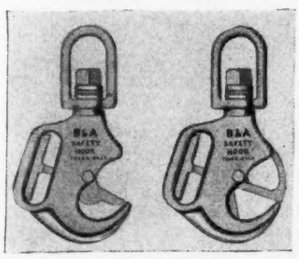
American Hoist & Derrick Co., St. Paul, Minn.

Flexibility equal to that of steam cranes is one of the features claimed for this gasoline-driven, three-speed crane which has an automotive-type gear shift that permits the use of low gear for a powerful start, intermediate for average crane work and traveling, and high gear for rapid traveling. These cranes are made in capacities ranging from 12 to 30 tons.

Safety Hook

B & A Specialty Co., Tulsa, Okla.

This hook, which weighs 27 lb., is made in but one size and has a tested load capacity of 20,000



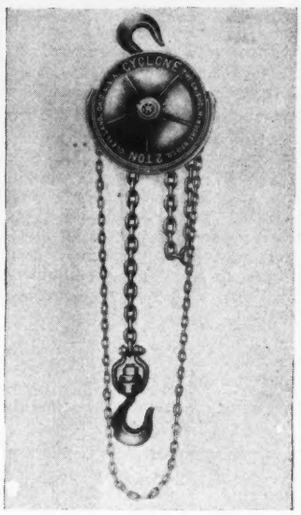
lb. It is 16 in. long, 9 in. wide and 2 in. thick; the body of which is a steel casting, whereas the bails are drop forgings, and balanced so that it is not necessary to lift the weight of the hook to insert the load, which locks the hook shut until it is opened by pressure on the handle.

Hoist, Chain, High-Speed

Chisholm-Moore Manufacturing Co., Cleveland Ohio

The entire mechanism of this Model K Cyclone chain hoist is inclosed in a dust-proof, oil-tight frame. This feature makes possible a minimum of attention inasmuch as it is only necessary to grease it but once a year under ordinary usage. It is built in units of from ½- to 6-ton capacity.

In the previous models, the rollers in the bearings were loose and had to be carefully fitted into their cage at the time

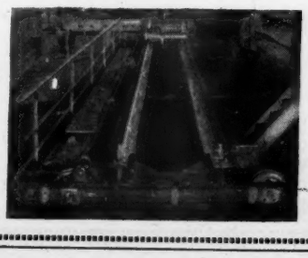


of assembly, but in this hoist the roller bearings are built in one complete unit which does away entirely with the ordinary loose rollers. This new hoist is constructed on the same gyrating yoke principle that is to be found in the previous Cyclone models, and according to the manufacturer, all parts are interchangeable.

Crane, Arc-Welded

Cleveland Crane & Engineering Co., Wickliffe, Ohio

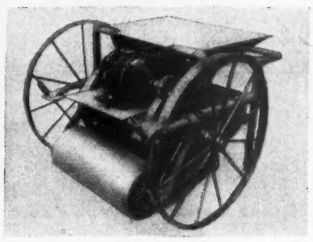
The bridge girder, end trucks and the trolley of this overhead traveling crane are constructed by arc welding; each girder being reinforced throughout its entire length by angles arc welded to the standard I-beam sections. The girders are attached to the end trucks by notched or shoulder construction to prevent weaving. The end trucks are built up of two, standard channel sections joined by arc welding. Each trolley frame is made of a standard channel with arc-welded braces under each bearing point. The field connection is made by bolts but additional arc-welded reinforcement is recommended to secure maximum rigidity.



Loader, Box Car

Stephens-Adamson Manufacturing Co., Aurora, Ill.

A box car loader utilizing centrifugal force to throw the material to the desired position in the car. The machine is a little larger than an ordinary wheelbarrow and can be easily manipulated and manœuvered by one man inside the car, and which can be loaded to capacity in 15 to 30 min., depending, of course,

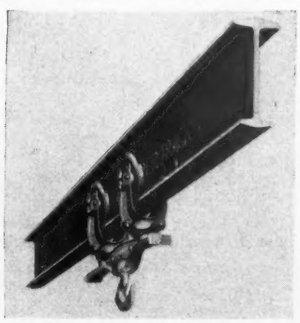


upon the nature of the material used. The Sinden loader as it is known, consists of a short, high-speed, motor-driven belt fed by a hopper and mounted on running gears consisting of two large iron wheels. The top of the loading hopper is 2 ft. 10 in. above the floor. The machine, which weighs about 730 lb., is operated by a 3-hp., 1,800-r.p.m. Westinghouse motor equipped with a Westinghouse safety starting switch.

Monorail System, Heavy-Duty

Loudon Machinery Co., Fairfield, Iowa

Special features distinguish the two- and three-way crosstrack and turntable switches designed



for use with this Loudon "Super-Track," which is a heavy-duty monorail system with a specified rated carrying capacity of 3,000 lb., and consisting of a special section approximately 6 in. deep with a 3-in. flange at the top and a 2-in. flange at the bottom. The track is available in straight lengths and curves, with switches and crossovers.

Tractor, Gas-Powered

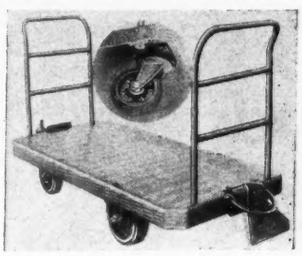
Mercury Manufacturing Co., 4118 So. Halsted St., Chicago, Ill.

Power is supplied by a four-cylinder (3⅜x4½-in.) Continental Red Seal gasoline engine with an S.A.E. rating of 18.2 hp. The cylinders are cast en-bloc with removable head. A high-tension magneto with automatic spark control, a centrifugal water pump and a pressure oil pump are standard equipment. An automotive tubular type radiator is used.

Trailer, Steel, Rubber-Tired

Clark Tructractor Co., Battle Creek, Mich.

A steel trailer for general utility freighting with rubber-tired wheels, complete ball and roller bearing equipment and fitted with an automatic coupler. It is of standard warehouse and shop size, with a 3x6-ft. diamond-plate steel platform 14 in. from the ground. The body is



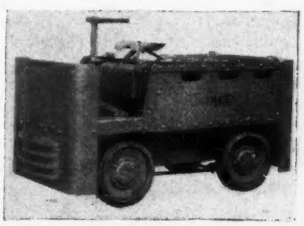
formed from a single sheet of ¼-in. diamond-plate steel. The complete unit weighs 550 pounds.

Tractor, Electric

Yale & Towne Manufacturing Co., Stamford, Conn.

This Model K24C, four-wheel-drive electric tractor is capable of exerting an ultimate drawbar pull in excess of 4,000 lb., and maintaining a continuous drawbar pull of 1,000 lb. without danger of overheating. It is equipped with four-wheel brakes which operate through the differentials.

The drive consists of two standardized units connected in parallel at the controller. This tractor is furnished with a



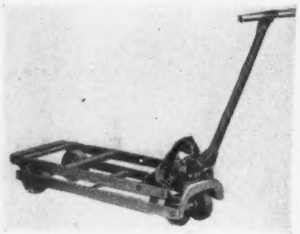
48-volt motor, and a 23-to-1 gear ratio. The pressed steel side members of the frame are integral with the axle yokes, thus giving the frame a depth of 18 inches.

Truck, Lift

Lewis-Shepard Co., Watertown, Mass.

Lifting the load with a single stroke of the handle is the principal feature claimed for this

Type R lift truck which can be operated with the handle in any position within a radius of 180 deg. The lift is accomplished both by rolling movement and by direct, vertical thrust movement. With the handle at the side the lifting force has no



tendency to tip the load because the pulling force is always centered. The lifting mechanism is so constructed that the handle is never disengaged from the load when it is lowered. This lift truck is constructed throughout of malleable iron and steel with the exception of the wheels which are cast iron.

Truck, Welded

Pittsburgh Producers Supply Co., Pittsburgh, Pa.

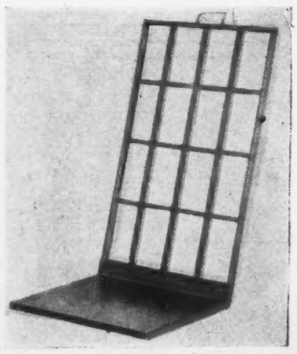
Designed for use in steel mills, particularly for handling wire in coils from wire or nail mills or

sheets, plates, and similar material from sheet mills, this shop truck, known as the "Weldsteel" has a rated capacity of three tons. It is 5 ft. long, 3 ft. wide, and 3½ ft. high. The truck is made from welded steel sections.

Hand Truck, Platform

American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.

A flexibility comparable to that supplied by tractors, lift trucks, and skids, is obtained with this pressed steel hand-truck plat-



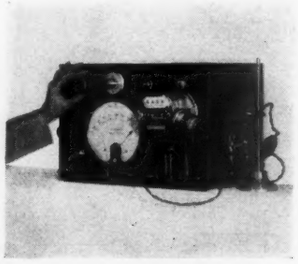
form which is known as the "Truk-Pak." The deck is a steel plate welded to two steel forgings which are bent upward and welded to the inside of a channel platform. The deck is raised far enough above the floor level to make room for the truck nose to enter without lifting or disturbing the load. Its dimensions, 28 in. wide by 48 in. high, make this rack suitable for use with almost every style and size of hand truck. They are proportioned so as to stand upright, either loaded or empty, and to be nested in stacks when not in use.

Meters and Accessories

Testing Device, Meter

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

This instrument is designed along the principle of the stroboscope, a device used to



analyze periodic motion. The speed of the meter is measured by viewing a series of marks on the elements through a synchronized flickering light beam. When the marks appear to stand still, the stroboscopic light is synchronized with the speed of the meter disk. A pointer indicates the percentage over or under the correct reading.

Test Handles

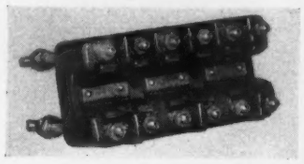
Metropolitan Manufacturing & Electric Co., 1163 Sedgwick St., Chicago, Ill.

The points of these two "Meco" handles, Nos. 115 and 117, are cadmium plated for use as test prods with the Metropolitan Portable Trouble Shooter. Instant connection without tools, solder, or tape expedites battery, automotive and other electrical test work. The handles are slotted to facilitate changing leads which may be of any size of wire up to No. 8 B&S gage.

Test Blocks and Plugs

General Electric Co., Schenectady, N. Y.

These Type PK test blocks and plugs simplify the connections when testing meters, instru-



ments and relays. The blocks are essentially four-pole and six-pole jacks, provided with covers having internal plug contacts which make a thorough connection when the plug is in place. Various combinations of auxiliary contacts are provided that automatically short-circuit the current transformer when the cover is removed. A block and cover are, therefore, equivalent to a double-throw test switch. Both test plugs are provided with studs and links, and may be permanently connected to the testing equipment for any of the various test methods in use.

Switch, Meter Test

Trumbull Electric Manufacturing Co., Plainville, Conn.

A slate-base test block inclosed in a steel cabinet constitutes the elements of this 30-amp., 250-volt meter testing switch which is intended for use with current or potential transformers. The top end of the cabinet is equipped with a shutter containing knockouts for all standardized meters. The test block consists of three, single-pole switches which control the meter potential coils, and two double-pole switches which control the meter current coils. The latter switches have an auxiliary jaw by which the current transformer is short-circuited when the switch is open. The arrangement of switches is such that the front cover cannot be replaced without first closing the switches.

Tachometer, Electric

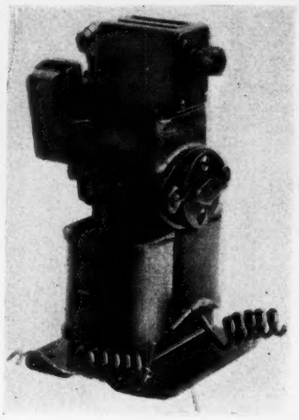
The Pyrometer Instrument Co., 74 Reade St., New York City.

This Pyro Electric Tachometer, Type A, will indicate speeds up to 3,000 r.p.m. The generator is not a dynamo, according to the manufacturer, but operates on a novel application of the electric current generated by revolving its shaft in a magnetic field and rectifying the electric energy in such a manner as to enable it to operate a meter which shows the number of revolutions per minute.

Counter, Magnetic

The Veeder Manufacturing Co., Hartford, Conn.

The operating principles of these 55-, 110- or 220-volt a.c. magnetic counters are the same as for the d.c. magnetic counters manufactured by this company. With both types, the closing of a contact at each cycle of operation of the machine under observation, energizes the magnet coils and actuates the mechanism which moves the number wheels. A magnetic counter is essential where the counter must be placed at some distance from

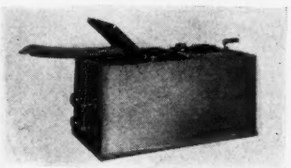


the machine on which the count is to be taken. According to the manufacturer, these counters are not recommended for a speed much in excess of 600 revolutions per minute.

Tester, Ground Resistance

James G. Biddle, 1211 Arch St., Philadelphia, Pa.

A ground resistance tester for directly measuring resistance to earth of all types of ground connections. The manufacturer states that it permits rapid and accurate testing of all types of grounds and ground connections such as driven pipes, burled

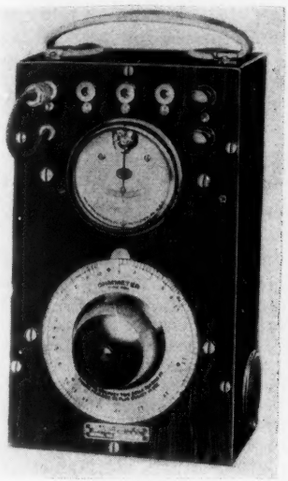


plates or strips, patented grounding devices, lightning arrester grounds, water pipes, ground wires, steel structures and the like. The instrument is sold under the trade name "Megger" and is known as the "Megger" ground resistance tester. It is direct reading in ohms by means of a pointer on a scale, and only one reading is required to obtain the actual ground resistance. Two instruments are available; one having the ranges 0 to 15, and 0 to 150 ohms, and the other 0 to 30 and 0 to 300 ohms. Higher ranges are available on application.

Ohmmeter, Direct-Reading

Roller-Smith Co., 233 Broadway, New York, N. Y.

This direct-reading instrument known as the Type COM Ohm-



meter is a form of slide-wire ohmmeter, designed with particular reference to speed and simplicity of operation. There are four ranges available: 0.5 to 50, 5 to 500, 500 to 5,000 and 5,000 to 50,000 ohms. The overall dimensions are 5¾ in. wide x 9¾ in. long x 4¼ in. high. The net weight is 3½ lb. A thick leather handle is attached to the upper end and heavy rubber feet are secured to the bottom of the case. The battery for this ohmmeter is self-contained and consists of two standard cylindrical flashlight cells.

Recorder, Continuous-Chart

Brown Instrument Co., Philadelphia, Pa.

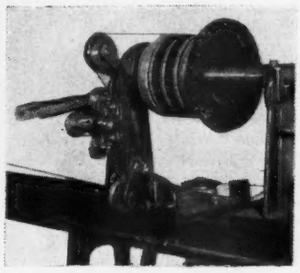
In addition to the flush-type circular cases supplied with its pressure gages, thermometers and flow meters, this company is now able to furnish its continuous-strip chart instruments in cases of the same type. A simple but important feature of the new flush-type, continuous-chart recorder is an arrangement by which the recording mechanism can be drawn out of the case at the front for easy inspection, after which it can be pushed back into place. A locking device holds it firmly in position.

Indicator, Tension, for Banding Wire

General Electric Co., Schenectady, N. Y.

A device for use in repairing railway and industrial haulage motor armatures to indicate the exact tension in pounds that is applied to the steel banding wire. The indicator which can be applied to practically any type of armature-banding machine is equipped with a rotary dial that can be turned to any position by loosening a nut and setting the pointer at zero so that the scale may be read at any angle. The indicator dial is graduated from zero to 500 lb., allowing the use of any size of banding wire within the range of the machine.

One of the important features of the indicator is that the center pulley wheel over which the wire runs is actuated by a heavy

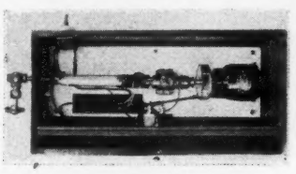


coil spring so that when the banding machine or lathe is started and stopped, a constant tension is maintained on the wire, which action prevents it from loosening.

Indicator, Flammable Vapor, Continuous

Mine Safety Appliances Co., Braddock Ave. & Thomas Boulevard, Pittsburgh, Pa.

Designed to continuously indicate the degree of inflammability or proximity to explosive conditions of combustible gases or vapor liberated in processes such as lacquering and japanning, this device known as the F-M Continuous Flammable Vapor Indicator operates as follows: the sample to be tested is led continuously to the apparatus where it passes through a small heating coil to prevent the condensation of any vapor. After passing to and from a flash-back arrester, the sample enters the detector unit which consists of a short piece of asbestos tubing incasing a themocouple, the whole being surrounded with a small electric heating coil. The sample, on coming in contact with the de-



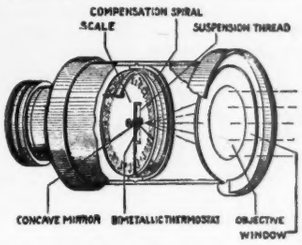
tector unit is heated to a temperature sufficient to cause combustion which is activated by the catalyst. The degree of increase in temperature, and correspondingly, the amount of electrical energy produced, is proportional to the amount of flammable vapor present.

Pyrometer, Total-Radiation Type

Colonial Supply Co., 217 Water St., Pittsburgh, Pa.

The principle on which this K & S Pocket Radiation Pyrometer operates is the measurement of the total radiant energy emitted by a hot body whose temperature is to be determined. All working parts are completely inclosed and protected in a dust-proof housing. The overall dimensions being 6 in. long and 2 in. in diameter; the weight 6 ounces.

According to the manufacturer, this instrument has a distance factor of about 12, which means that the distance from the instrument to the furnace opening or piece of material

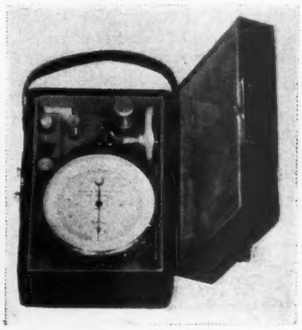


whose temperature is to be measures should not be more than twelve times the diameter of the opening.

Tachometers, Single- and Multi-Range

Herman H. Sticht & Co., 17 Park Row, New York, N. Y.

Acceleration speeds and other forms of speed variation may be obtained with these single- and multi-range tachometers, which contain a centrifugal type measuring element that reads directly in revolutions per minute, and shows the values in-



stantaneously. Among the advantages claimed for the single-range type are the following: It has no gears to shift or to be damaged due to carelessness; and is very easy to read.

Meter, Indicating, Flow

Merriam Company, Cleveland, Ohio.

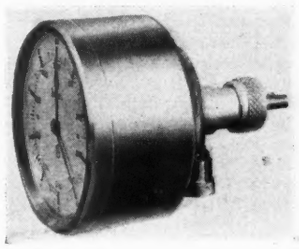
Designed primarily for high line pressure, 1,000 lb. per sq.in., this indicating flow meter which is suitable for measuring the flow of air, gas, saturated or superheated steam and other liquids at any temperature, may be used with equally satisfactory results on vacuum or on low pressure.

Instead of using threaded unions, all pipe lines are welded in order to avoid inaccurate reading due to leakage which is common in view of the very high pressure dealt with in many cases.

Meter, Running-Time

R. W. Crane & Co., Inc., 136 Liberty St., New York, N. Y.

The actual productive time for a day, a week, a month or a year may be recorded with this device, known as the "Hasler Tell," which can be driven from any rotating member of a machine. It registers with equal accuracy in both directions of rotation, at any speed of rotation for any type of operation whether uniform or variable, constant or intermittent. It registers and totalizes automatically and is read like a clock. It weighs 28 oz., and measures

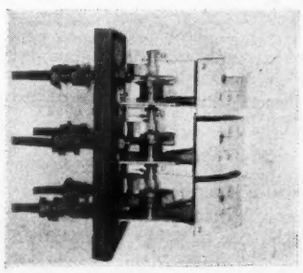


3½ in. in diameter by 2½ in. deep. No attention is required beyond an occasional twist of the grease cup lubricating the drive shaft.

Ammeter, Polyphase-Unit

Roller-Smith Co., 233 Broadway, New York, N. Y.

Three horizontal edgewise mechanisms mounted one above the other in a single case and utilizing one window to permit simultaneous readings constitutes this Type HEA-3 polyphase ammeter which supplements the Type B triplex, three-phase ammeter. The mechanism are of the standard electro-magnet type and so shielded from each other that there is no mutual interference. The individual scales are the same



length as those in the standard Type HEA meter. The base dimensions are 8⅜ in. wide, 9⅝ in. high with the case projecting 6$\frac{29}{32}$ in. from the board.

Motor and Generator Equipment

Frequency Changer

Forbes & Meyers, 172 Union St., Worcester, Mass.

This is a further development of the frequency changer made by this company, with simplifi-

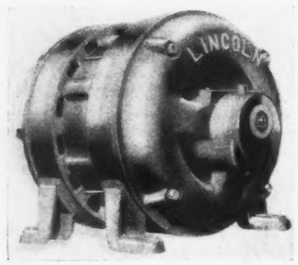
cation of the construction. It is built in ratings of 0.1 to 3 kva for changing two- or three-phase, 60-cycle power of any voltage to single- two or three-phase, 180-cycle power.

The construction of the frequency changer is similar to that of the ordinary induction motor. The stator has two windings—a two-pole windings, which is connected to the 60-cycle power source and a six-pole winding which delivers 180-cycle power.

Motor, Full-Voltage Starting

The Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio

This motor is designed for starting directly across the line, with the starting current below the

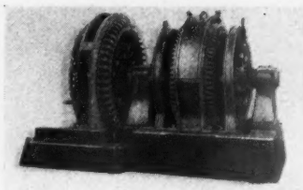


N.E.L.A.requirements. It is available in ratings of ½ to 30 hp., two or three phase, 60 cycles. Welded steel construction is used throughout in these motors, which are normally equipped with sleeve bearings, although ball bearings can be furnished upon request.

Motor-Generators, Low Voltage

The Electric Products Co., Clarkstone Road, Cleveland, Ohio

A complete line of low-voltage motor-generator sets has been designed to meet modern electroplating requirements. The generators are available in

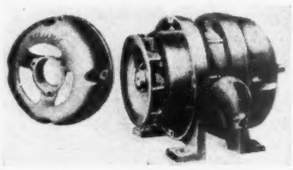


either shunt- or compound-wound types, the percentage of compounding being governed by the conditions of the service. Features of construction include reaction-type brush-holders of the latest design, with liberal proportions to insure low current density, and the use of a generator field ring made of rolled steel, electrically welded to insure uniform distribution of flux.

Motor, Fully-Enclosed

The Reliance Electric & Engineering Co., 1042-90 Ivanhoe Road, Cleveland, Ohio

One of the principal advantages claimed for this fully-inclosed motor, known as Type AA, is



that the method of ventilation employed makes it possible, in most cases, to operate the motor at the full open-type rating. Internal fans are used to circulate the air around the coil heads, where a large part of the heat is generated. This causes the internal heat to be transmitted to radiating bonnets that surround the coil heads and seal the motor. The external appearance and the mounting dimensions are the same as for a standard induction motor of the same frame size.

Motor, Split-Phase

Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo.

Several improvements in design are embodied in the split-phase motor designated as 58RB introduced by the above company. They include an improved method of oiling, a heavy formed steel base that cannot be broken,

drip-proof endplates and a new centrifugal switch. The switch, which consists of only a few simple parts, is said to be constructed so that it always breaks contact at the proper time, almost instantly and without dragging. The 58RB motor is available in ⅛-, ⅙- and ¼-hp. ratings.

Motor, Inclosed

Sterling Electric Motors, Inc., Telegraph Road at Atlantic Ave., Los Angeles, Calif.

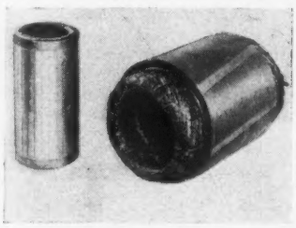
This inclosed ventilated motor can be pipe ventilated, copper shielded and ventilated, or totally

inclosed, which makes it suitable for many kinds of service. It is designed for 220- or 440-volt operation and is available in ratings of ¼ to 30 hp. in all speeds. A single-phase type of the same construction can be furnished in sizes ranging from ¼ to 5 hp. Protected ball or rollers bearings, as desired, are standard equipment on these motors.

Motor, Shell-Type

The Lincoln Electric Co., Cleveland, Ohio

A squirrel-cage motor for use in various kinds of woodworking machinery and other equip-

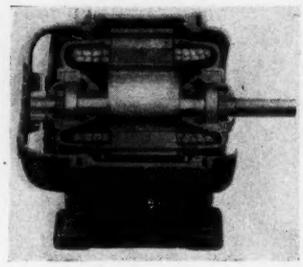


ment requiring high - speed motors. It is of the so-called shell type in an all-welded design and can be supplied in 3-hp. and 5-hp. ratings. The 3-hp. unit has an external diameter of 6½ in. and an external length of 4½ in. The 5-hp. motor is of the same diameter and is 6 in. in length. Both motors can be furnished for operation on either two- or three-phase, 60-cycle current, at a speed of 3,600 revolutions per minute.

Motor, Totally-Inclosed

American Electric Motor Co., Cedarburg, Wis.

Inclosed hoods hermetically seal the windings of this completely-inclosed, ventilated motor. The hoods are telescoped into a ring



fastened to the stator laminations, the surfaces of which are machined. Cooling of this Type PK motor is unusual in that air is driven through, as well as over, the stator laminations. The stator core is perforated, thereby making it possible to remove the heat where it originates. The air in the inclosed portions is agitated by malleable-iron fans shrunk on the motor shaft. Ball bearings of the cage type are used and the inclosing hood of the motor can be removed without disturbing them. The entrance of dirt to the bearings and leakage of grease from them are prevented by felt washers embedded in the caps.

Motor, Full-Voltage Starting

Allis-Chalmers Manufacturing Co., Milwaukee, Wis.

This line of motors comprises normal - torque, high - reactance

machines, whose starting current when started on full voltage is not in excess of the limits recommended by the Electrical Apparatus Committee of the National Electric Light Association. They are built in ratings of 7½ to 30 hp., 600 to 3,600 r.p.m., for low voltages, and are available with either sleeve or roller bearings. A magnetic switch with push-button control is the only starting equipment required.

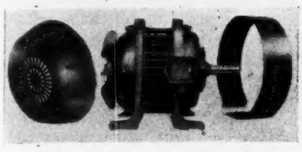
Motor, Inclosed

Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis, Mo.

The motor is surrounded by a jacket open at both ends, with fan blades on a shaft extension between the sealed motor and the outer jacket. The only clearance between the rotating and stationary parts is in the greased-packed bearing housing.

The frame housing, stator, and all bearings are substantially air tight.

Double-row ball bearings are used in these motors; they are self aligning in one endplate and



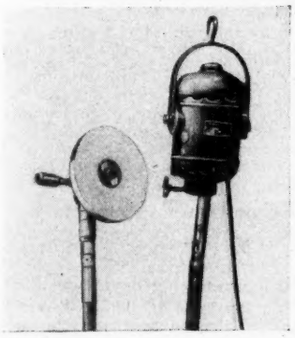
the deep grooved type in the other to take end thrust.

Single-phase, repulsion-induction motors can be furnished in sizes from 1 to 20 hp. and polyphase squirrel-cage motors in sizes from 2 to 30 hp. These motors are designed for a temperature rise not to exceed 50 deg. centigrade.

Motor, Suspended Unit

Stow Manufacturing Co., Inc., Binghamton, N. Y.

This unit comprises a ball-bearing, 1-hp. motor fitted with a flexible shaft. The standard



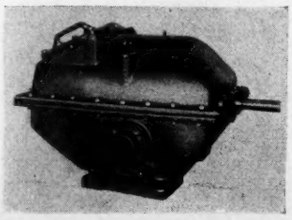
length of shaft for this unit is 6 ft., although other lengths will be furnished on request. This unit is intended for driving rotary files, sanding discs, grinding wheels, and the like, either directly or through an angle head, as conditions require.

Motors, Inclosed

General Electric Co., Schenectady, N. Y.

Bearing the General Electric designation Class BU, Form JA, these motors are totally inclosed. The object is to reduce the danger that heat generated within, from any cause whatever, will cause the ignition of any gases surrounding the equipment.

A two-piece, cast-iron exterior is provided, heavy enough to



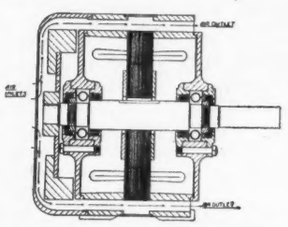
withstand the pressure of an internal explosion, and with wide, flanged joints. No gaskets are used, as the motor is not intended to be gas tight.

The a.c. motors of this type are available in single-phase ratings up to 3 hp., and in polyphase ratings up to 15 hp. at standard voltages and speeds. Direct-current motors can be furnished in standard speeds and voltages with horsepower ratings from ¾ to 5 hp. These motors in both a.c. and d.c. types are designed to operate within a temperature rise of 55 degrees.

Motor, Totally-Inclosed

Cleveland Electric Motor Co., 5311 Windsor Ave., Cleveland, Ohio

This motor is built with a double shell. The inner shell, which contains the entire motor,

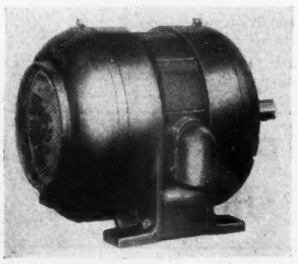


is completely inclosed and dust proof. It is mounted in the outer shell so as to allow a free air space between them, the shaft passing through both. One end cover of the outer shell is provided with a hole for admitting air. At the end away from the motor pulley a fan is mounted in the space between the inner and outer end covers. This draws in a steady current of air through the holes and throws it over the outer surface of the inner shell.

Motor, Inclosed

Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

In this design all of the active parts, such as the stator core, stator windings and the rotor,



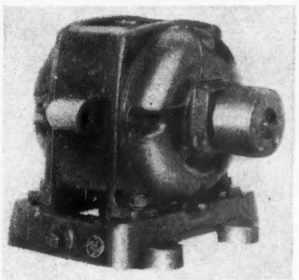
are completely inclosed, preventing contact of outside air, dirt, moisture, and so on, with the interior or active parts. The heat developed in operation is carried away by a sufficient volume of cooling air forced around and across those parts which conduct the heat from the interior to the outer surfaces. A circumferential air jacket controls the path of the cooling air.

Solid cast-iron bearing houses are attached to the stator end head with a machined fit, which, with grease-packed bearings form a perfect enclosure. The internal parts of the motor are accessible by the removal of the housing.

Motor, Single-Phase

General Electric Company, Schenectady, N. Y.

This design, available in ¾-, 1-, 1½- and 2-hp. ratings, at 1,800 r.p.m., supplements the present



General Electric line of SCR motors. It is of the constant-speed, high-starting torque type for general application. One of the most important improvements is the more efficient use of stator punchings.

The motor is inclosed except for ventilating openings in the lower portion of each end shield. Air is drawn through the ventilating openings at the pulley end by means of an internal fan, passes around the stator laminations, and out through the ventilating opening at the commutator end. This construction makes a practically inclosed motor, and provides protection against falling particles and splashing water. It is designed to operate within a temperature rise of 40 degrees.

Painting Equipment

Protective Coatings for Concrete

The Master Builders Co., 7016 Euclid Ave., Cleveland, Ohio

Two preparations are available. One of these, known as Stainproof, is a thick liquid that is applied to the floor like paint. It dries to a tough coating that is said to be stain preventing and wear resisting, and is allowed to remain on the floor until all building operations are finished. Then the coating can be removed by soaking with water and scrubbing.

The other protective coating, Masterseal, is a transparent and colorless liquid that is applied like paint to new concrete, marble and similar surfaces, and seals them against the absorption of moisture.

Spray Painting Outfit

Plummer-Huff Co., Napoleon, Ohio

This spray painting outfit is available in two sizes. The Junior Handigrip outfit, consisting of a motor-driven compressor, air tank and cup gun, has a rated coverage of about 8 sq.ft. per min. If desired, a paint hose can be attached in place of the gun. The cup gun is used for touch-up work and minor maintenance painting.

The larger 1C Junior unit uses a Handigrip paint gun attached by hose to a 2-gal. paint tank, and has a rated capacity of about 30 sq.ft. per min. This outfit is intended for painting larger areas. Both units are portable and are driven by a ½-hp. motor.

Spray Gun

The Alexander Milburn Co., 1416-28 W. Baltimore St., Baltimore, Md.

The extremely fine mist obtainable with this gun makes it suitable for use in decorating,

shading, high-lighting and blending of colors on any surface, as well as for touching up scratches or damaged spots in the finish of various types of equipment. This spray gun can be operated from an air compressor driven by a ¼-hp. motor. Six feet of air hose with connections are furnished with the gun. Either aluminum or glass containers can be furnished so that as many different colors as desired can be kept on hand for ready use.

Paint Spray, Handy Size

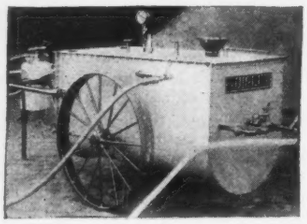
The Electric Sprayit Co., Inc., South Bend, Ind.

This is a hand-size, motor-driven blower with a detachable container attached to the blower, and is provided with a cord for plugging into a lighting socket. It is sold under the trade name of Electric Sprayit, and is intended for use with light-bodied paints, varnishes, lacquers and other finishing media as well as insecticides, disinfectants, etc., in liquid or powdered form.

Spray Gun, Bituminous Materials

Quigley Furnace Specialty Co., 26 Cortlandt St., New York, N. Y.

This is an adaptation of this company's refractory gun, consisting of a cast-iron cylinder



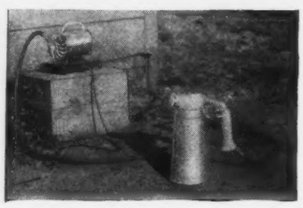
from which the material is forced by a piston capable of exerting high pressure. The gun is inclosed in a steel housing mounted on wheels. Its capacity is 15 gal., enough to cover approximately 400 sq.ft. of surface. The temperature of the material in the gun is regulated by a small,-self-contained kerosene burner. A large scale thermometer shows the temperature of the material.

It is claimed that material is forced through the hose with a drop in temperature not exceeding 3 deg. for each 25 ft. of length. The discharge end of the nozzle can be bent at any angle, making it possible to reach otherwise inaccessible places.

Spray Painting Outfit

Atomister Corporation, Rahway, N. J.

Weighing only 5 lb., this outfit consists of a universal-type motor, for operation on either



alternating or direct current, which drives a small compressing unit and delivers air at 17 to 20 lb. pressure for producing the spray. The paint or other material is placed in the container attached to the lower part of the casting on which the motor and compressing unit are mounted. The paint container is of 1-quart capacity.

The motor is controlled by a trigger switch in the handle of the outfit, which is designed to operate from any light socket and is intended to handle a variety of industrial painting jobs.

Air Brush

Paasche Air Brush Co., 1909-23 Diversey Parkway, Chicago, Ill.

A multiple-head air brush designated as the Lo-Hi, with pressure-feed attachment. Multiple heads in five sizes, each in five different types, make it possible to handle a wide range of air painting requirements. A swivel, slanting fluid inlet gives a rapid and straight flow of material and, it is claimed, makes cleaning simpler.

The air brush is equipped with a two-finger steel trigger that

facilitates ease and accuracy of control. This brush will operate on air pressures ranging from 6 lb. to 125 lb.—giving a consumption of 2 cu.ft. to 20 cu.ft.—by changing heads.

Paint Spray Outfit

The Electric Sprayit Co., South Bend, Ind.

In the Superior model, pressure for atomizing the material to be applied is obtained from the

self-contained, direct-connected rotary compressor, the rotor of which is mounted on the armature shaft of the motor.

The pressure developed by this model is stepped up to a point sufficient to handle practically any type of material. It has been designed for the application of paints, enamels, varnishes, lacquers and other materials where a fine finish is required.

Paint Spray Gun

The Alexander Milburn Co., 1416-28 W. Baltimore St., Baltimore, Md.

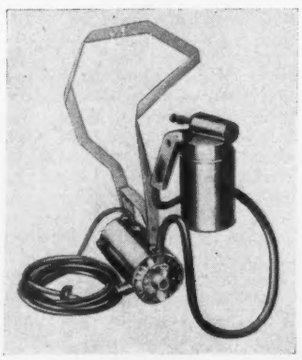
Incorporated in the design of the Type EF spray gun is a dial head that gives many different spray adjustments from a circular spray to a wider field than has hitherto been possible. Use of the dial permits the operator to obtain any desired spray quickly without first making tests. A series of indicator numerals have also been added to the paint valve plunger. These indicator numerals make it possible to provide the exact volume desired without loss of time through testing.

The advantage of this feature is that when the operator has found that a certain class of work is best performed when the indicator points to a certain figure, he can make the proper adjustment before beginning to spray.

Paint Spray Gun

Weil Machine Company, Detroit, Michigan

One prominent feature of the Weil Lectrospray is the arrangement of the motor compressor



unit, which may be slung over the shoulder on a strap, or placed on a bench or on the floor.

This unit is designed to be operated from any electric light socket and it is claimed that adequate pressure is generated by the compressor to produce a uniform spray of any liquid finishing material. The density of the spray is controlled by adjusting the nozzle.

Plant Service Equipment

Extinguisher, Hand, Pressure Tank

Foamite - Childs Corporation, Utica, N. Y.

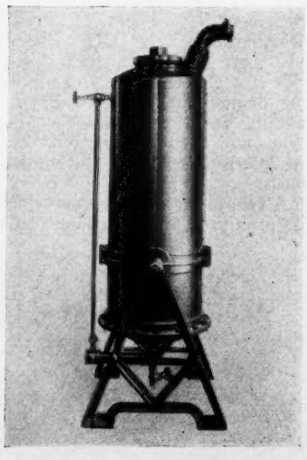
This 1-gal. unit, known as the F.R.X. Carbon - Tetrachloride Extinguisher which is especially adapted for use around electrical equipment or lines, on oil fires and in unheated buildings, operates from an air pressure tank. The unit consists of two, seamless brass tanks or chambers, one for compressed air and the other for carbon-tetrachloride fitted into top and bottom brass castings. A pump is located between the cylinders to replenish the air or the cylinder may be charged from a compressed air line. A gage shows the air pressure at all times and a glass window in the chemical tank shows the level of the ex-

tinguishing fluid. Pulling the operating lever discharges the compressed air into the chemical tank and opens the outlet. It will discharge a continuous stream 35 ft. without pumping.

Accumulator, Phomene

Pyrene Manufacturing Co., 560 Belmont Ave., Newark, N. J.

A foam-making device designed for permanent installation to provide automatic fire protection for particularly free-burning hazards. The accumulator normally contains a charge of a dry powder that produces a thick foam when mixed with water. When fire breaks out, the opening of one or more standard sprinkler heads located at the hazards allows water to be forced into the accumulator from which the foam mixture is discharged. Under a water pressure of from 50 to 60 lb. per sq.in., the accumulator will

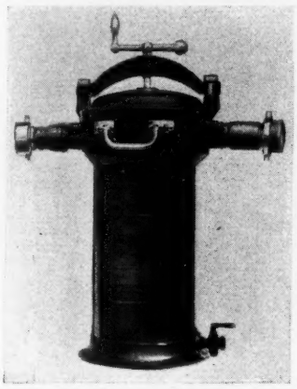


discharge 2,400 gal. of foam in about 2½ min.; with a lower water pressure the rate of discharge is slightly decreased.

Accumulator, Phomene, Model 401

Pyrene Manufacturing Co., 560 Belmont Ave., Newark, N. J.

This device is designed to supply foam consisting of bubbles filled with carbon dioxide gas

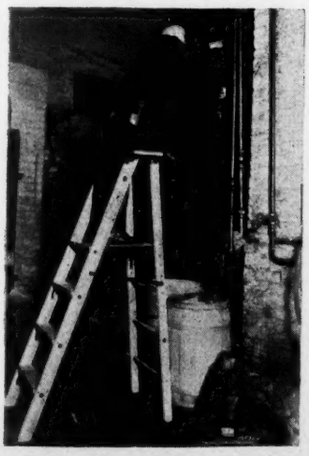


for fighting oil and other fires that cannot be extinguished by water. The accumulator is charged by placing in it a container of foam-making powder. More than 280 gal. of foam can be obtained from one container of powder. The time of discharge is from 1½ to 1¾ min. For proper operation, this Model 401 accumulator requires an applied water pressure of 30 lb. per sq.in. or more. If desired, this accumulator can be supplied for automatic or semi-automatic operation, or for portable use.

Step-Ladder, Platform

The Patent Scaffolding Co., 1550 Dayton St., Chicago, Ill.

These ladders which are made of straight-grained Canadian spruce and selected hardwood are available in sizes ranging from 3 to 18 ft. in length. An automatically-folding platform



provides ample room for the feet and increases freedom of action. With the addition of a plank or light platform two ladders can be used to advantage for the construction of a temporary scaffold as the back rungs coincide in elevation with the steps.

Box Rack, Sectional

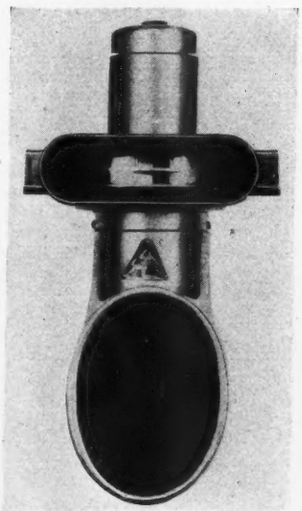
The Skinner Chuck Co., New Britain, Conn.

Ease of assembly, together with the convenience of adding additional drawer capacity from time to time, are two of the features offered by the "Sturdy-Sectional" Stock Racks. The cast-iron braces are assembled by means of stove bolts and a special locking device. Welded steel drawers 8x12x20 in. in size are regularly provided. The drawers travel on rollers set in the frame, so that even when the box is heavily loaded, little effort is required to handle them.

Siren

Christian A. Volf, 366 Madison Ave., New York, N. Y.

A motor vehicle siren, known as the Luren which may be used with automatic call and signal

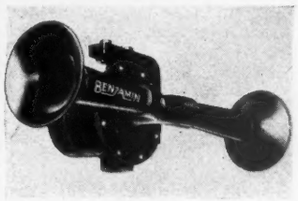


systems. It is featured with two separate horns and an entirely closed sounding box.

Signal, Motor-Driven

Benjamin Electric Manufacturing Co., 120-128 Sangamon St., Chicago, Ill.

These projector-type, motor-driven signals with single or double horns are intended for use in such locations as steel mills, railroad shops, foundries, cotton mills, screw machine departments and machine shops where a signal must compete with excessively loud noises.



They are equally well adapted for either outdoor or indoor installation. They may also be used on code calling systems whether controlled by a push-button or an automatic calling device.

Barrel, Stand

Economy Engineering Co., 2643 W. Van Buren St., Chicago.

With this "Red Rocker" stand, one man can lift a 500-lb. barrel or drum of oil, paint, or

other liquid from a standing position on the floor and lay it horizontally on the stand as shown, for draining. The operation of placing a barrel or drum on the stand is somewhat similar to loading a two-wheel, warehouse-type truck. The stands which are furnished in two sizes are made of electrically welded, angle-iron. The smaller unit raises the faucet 18 in. from the floor, and the larger unit, 24 inches. The two stands weigh 33 and 42 lb. respectively.

Power Transmission Equipment

Ball Bearings, Split

Split Ball Bearing Corporation, Lebanon, N. H.

These split ball bearings are designed for use on lineshafts and other applications where replacing or repair of single-piece bearings would involve taking down shafts and the removal of pulleys or couplings.

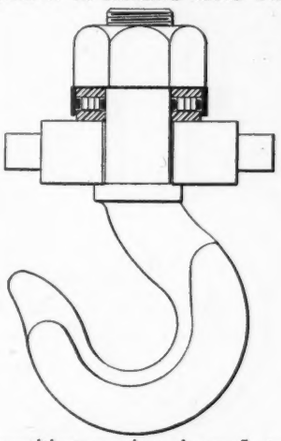
The component parts of a complete bearing are: A sleeve bored to fit the shaft, split longitudinally and held together with screws and dowels; a bearing shell, also split longitudinally and held together by similar means; a sufficient number of balls to fill the races; and spacers to separate the individual balls. These bearings are made for all commercial sizes of shafting up to 2 1/16 in. in diameter.

Roller Bearings, Crane Hook

Rollway Bearing Co., Inc., Syracuse, N. Y.

Rollers and thrust plates in these bearings are made of high-chrome, high-carbon, alloy steel, heat-treated to give uniform hardness. A weather shed which also serves as a lubricant retainer is provided to give the necessary protection to the bearing parts.

The bearings are made in sizes to fit standard hooks with

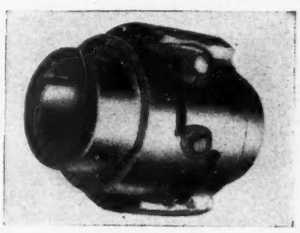


capacities ranging from 5 to 100 tons. Larger sizes can be furnished on order. It is stated that these bearings make it possible for one man to turn a 30- to 40-ton load with ease.

Coupling, Flexible

Lovejoy Tool Works, 319-31 W. Ohio St., Chicago, Ill.

This is substantially a jaw coupling with radially-disposed, loosely-floating resilient rollers, placed between jaws which ex-

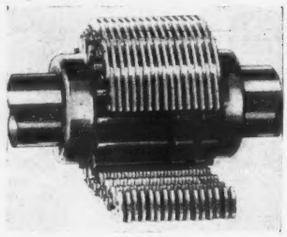


tend from the flanges parallel with the shaft. This assures a rolling contact upon relative movement caused by either misalignment or end movement of the shaft. Either solid rubber or rubber-covered metal rollers are used, as conditions require. This coupling may be used for rotation in either direction.

Coupling, Flexible

Morse Chain Co., Ithaca, N. Y.

This coupling consists primarily of a chain wrapping two sprockets, each of which is one-half the width of the chain. One sprocket is provided with guide grooves in the center of the face to hold the chain in place,

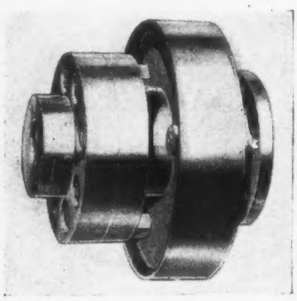


whereas the other sprocket is free to float under the chain without the guide. The chain fits loosely enough on the sprockets to take care of ordinary misalignment.

Back-Stop and Coupling

D. O. James Manufacturing Co., 1120 W. Monroe St., Chicago.

Both the functions of the automatic back-stop and of a flexible coupling are combined in



this device. It is designed especially for use on elevator conveyors and process equipment drives where there is likelihood of reversal of travel after the equipment has been standing idle. The back-stop is applied on the drive shaft between the speed reducer and the driving motor.

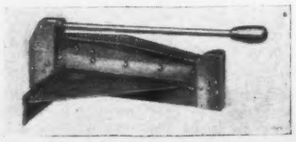
A ratchet operates within a drum housing which is connected to the motor shaft. On the inner face of the housing are three pawls that engage the ratchet as soon as the housing stops.

Centrifugal force keeps the pawls out of engagement during operation, but in case of accident, the pawls engage the ratchet through gravity and provide against reversal of travel.

Belt Cutter

The Clipper Belt Lacer Co., 974-1042 Front Ave., N.W., Grand Rapids, Mich.

This device will cut and square any make of belting up to and including stock 10 in. in width with a comparatively slight pressure on the handle. It is ruggedly built of malleable cast-

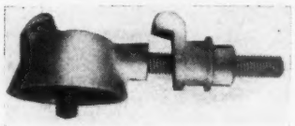


ings, cold-rolled steel and tool steel for durability in hard service. As a safety measure, it has been designed so that it is impossible to raise the blade high enough to become an injury hazard.

Trolley Hanger, I-Beam

Ohio Brass Co., Mansfield, Ohio

A combined insulated hanger and clamp for suspending mine and industrial trolley lines from I-beams. The design is such



that installation is considerably simpler than in the case of previously existing equipment.

This hanger is installed by hooking it over edges of the I-beam and tightening the holding unit. The standard size of hanger is made to fit I-beams or rails having a bottom width of 3 to 5 inches.

Hanger, Lineshaft

Hardware Products Co., 103 Richmond St., Boston, Mass.

Self-alignment of the bearings of these hangers, which are known as Microhite, is pro-

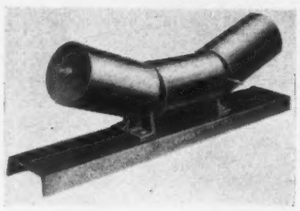
vided by their ability to move both in horizontal and vertical plane.

The bores of stock sizes of hangers range from ½ to 1 in. and the heights from the foot to the center line range from 3½ to 10½ in. The bearings are from 2 to 2½ in. in length. Hangers equipped with either ball or bronze bearings which are interchangeable, are available.

Idler, Belt Conveyor

Chicago Automatic Conveyor Co., 1845 So. 55th Ave., Cicero, Ill.

A number of improvements have been incorporated in the belt conveyor idlers made by

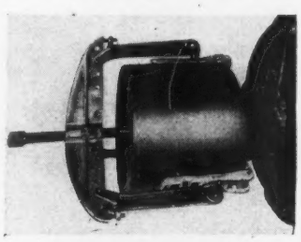


the above company. The pulleys are spaced ¼ in. apart to avoid belt creasing. Heavy steel tubing is used for the pulleys which have steel heads, electrically-welded flush with the ends eliminating dust pockets. A unit mounting is used for the bearings to keep them in perfect alignment. This mounting also serves as a grease reservoir. The machined cast-iron brackets which are used to avoid cramping the shaft, can be mounted on either wood or channel base.

Wheel Puller Extension Jaws

Crane Puller Co., Waltham, Mass.

These extension jaws are intended for use with the four sizes of wheel pullers manufac-



tured by this company and especially designed for removing wide-faced paper pulleys. Each size of extension jaw carries the same number as that of the Crow-Foot puller with which it is to be used.

Pulley, Semi-Steel

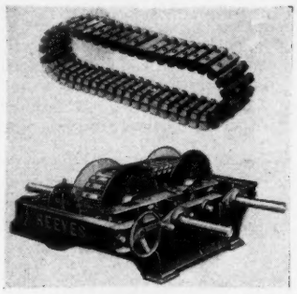
W. A. Jones Foundry & Machine Co., 4401 W. Roosevelt Road, Chicago, Ill.

Molded of semi-steel, these pulleys are claimed to be stronger and better looking than the types of cast pulleys now available. Inasmuch as they are solid cast units, they are free from the tendency to become wobbly in use. These pulleys are available in a complete line of sizes ranging from 2-in. to 50-in. diameter, and from 2-in. to 50-in. face in the solid type, and from 6-in. to 60-in. diameter and 3-in. to 50-in. face in the split type.

Transmission, Variable-Speed

Reeves Pulley Co., Columbus, Ind.

Among the several major improvements in this speed transmission unit is a new double-block, centerpull, V-belt. This belt, gives more than twice the surface contact previously obtained against the driving disks of the transmission unit, and insures more quiet and efficient transmission of power.

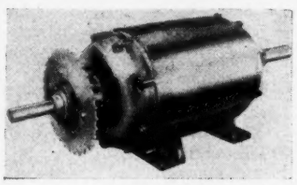


This variable-speed unit has also been equipped with a splice block of the double-pin interlocking type, with cast aluminum blocks and tool steel plates.

Changer, Speed

Stephens-Adamson Manufacturing Co., Aurora, Ill.

This "JFS" variable speed transmission is designed for direct connection to constant, high-speed motors to provide variable speed over a wide range. The rate of rotation of the low-speed shaft may be changed without interruption while the machine is in motion. The machine may be driven in either direction. Power is transmitted by the action of roller bearings revolving in polished races, submerged in oil. A hand or sprocket wheel is used to adjust the speed of the low-speed shaft. These units are made in two series with capac-

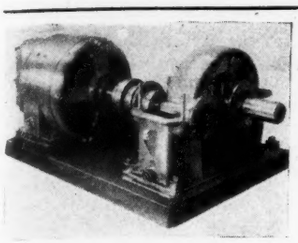


ities from ½ to 15 hp. at the maximum reduction. The first series provides a reduction of approximately 8 to 1 for the lowest speed, and approximately 40 to 1 for the second.

Speed Reducer, Herringbone

Farrel-Birmingham Co., Inc., 344 Vulcan St., Buffalo, N. Y.

Some of the features claimed for this improved design of speed reducer are as follows: The roller bearings are of the type that combine radial and thrust capacity; thus both the pinion and gear shaft are free from end float and are, therefore, protected from abuse from the connected mechanism. The lubrication is simpler than in the case of the plain bearing unit, since in all cases the same



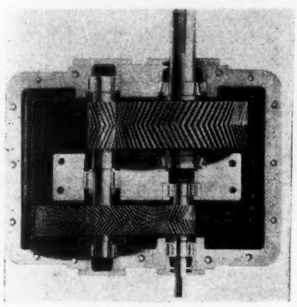
oil may be used for the gears and bearings and the splash and flood automatic system of lubrication is possible throughout this series of speed reducers.

Speed Reducer, Herringbone

D. O. James Manufacturing Co., 1120 W. Monroe St., Chicago.

This is a generated, continuous-tooth herringbone gear speed reducer available in both single and double types.

These reducers are completely



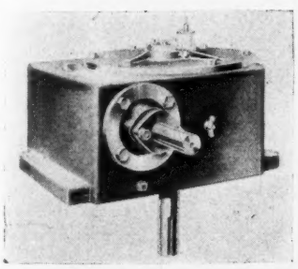
ly equipped with Hyatt roller bearings on the high, intermediate, and slow-speed pinion shaft, and Timken roller bearings on the slow-speed shaft.

Speed Reducer, Vertical-Type

D. O. James Manufacturing Co., 1120 W. Monroe St., Chicago.

A heavy-duty, worm-gear speed reducer designed for vertical driving with the drive shaft projecting at either the top or bottom.

The housing is provided with a large oil-cooling and heat-radiating chamber. Timken bearings support both sides of the gear shaft. The worm shaft is



mounted on double Timken bearings one side and Norma Hoffman roller bearings on the other.

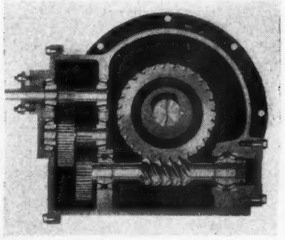
The gear shafts are 0.40 carbon steel made oversize to withstand emergency strains. Worms are made integral with worm shafts of S.A.E. 3140 chrome-nickel steel. Gears are of phosphor bronze, the larger sizes being made up of a bronze ring shrunk on and keyed to a cast-iron spider.

Speed Reducer, Agitator Drive

New England Tank & Tower Co., Everett, Mass.

In this drive, known as Model T37, speed reduction is accomplished through a combination of spur and worm gears.

Timken bearings are used



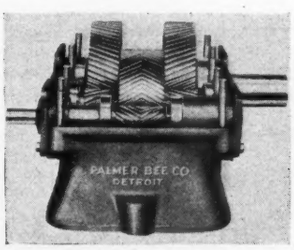
throughout and all working parts are operated in a bath of oil.

Among the other features are a positive oil trap that prevents oil from running down the vertical bearings, and wide spacing of the two vertical bearings which makes for stiffness of the vertical shaft.

Speed Reducer, Herringbone

Palmer-Bee Co., Detroit, Mich.

Reducers of the single series have one pair of continuous-



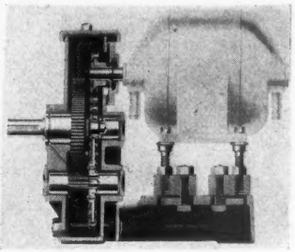
tooth herringbone gears. In the double and triple series the high-speed gears are continuous-tooth, herringbone type (Sykes generated) and the slow-speed gears are divided in the center, permitting an equal distribution of the load on bearings.

In this line of speed reducers anti-friction bearings are used throughout. Ball bearings are used on the high-speed, Hyatt bearings on the intermediate and Timken bearings on the slow-speed shaft. An efficiency of about 99 per cent is claimed for the single series reducers and approximately 97 per cent for the double series.

Speed Reducer, Motor-Mounted

Cullman Wheel Co., 1344-54 Artgeld St., Chicago, Ill.

In this speed reducer the motor and reducer have been combined into one unit to simplify installation.



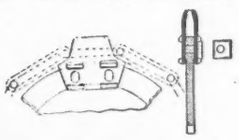
The housing, cover and motor base are of cast iron. The first reduction is made through a Diamond standard roller chain that connects a sprocket on the motor shaft and on the high-speed shaft of the gear trains. All bearings are of phosphor bronze. The motor is mounted on four adjustable studs.

These reducers are available in sizes suitable for use with motors ranging from ¼ to 5-hp. rating, and for various speed ratios.

Sprocket, Expansible-Tooth

Union Chain & Manufactturing Co., Sandusky, Ohio.

The sprocket is constructed with adjustable teeth of special design. Both sides of the body



rim are machined to receive the teeth, which are firmly clamped to the rim. Turned bolts project through elongated holes in the teeth, the latter being secured by means of square, bevelled-edge adjusting blocks fitted between the lugs on the teeth.

After the chain has elongated beyond a proper fit on the sprocket, the eccentric blocks are readjusted so as to expand the teeth to the next larger pitch diameter.

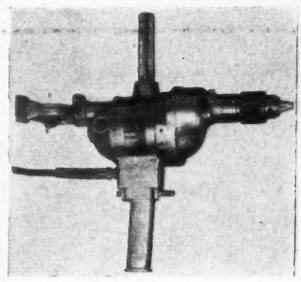
The teeth, which are made of alloy steel, can be replaced when they have worn out.

Shop Tools

Drill, Universal, ½-In., Electric

Standard Tool Co., Cincinnati, Ohio

Universal electric drill with capacity up to ½ in. in steel and 1

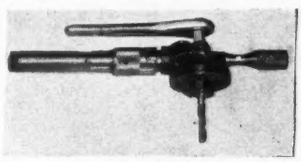


in. in hardwood. Air cooled G.E. motor for 60 cycles or less. SKF bearings are used. The gears are of hardened chrome nickel steel. A 10-amp. switch is provided. The motor housing is made of aluminum.

Angle Head

Stow Manufacturing Co., Inc., Binghamton, N. Y.

This tool is intended to be used for drilling in soft wood and metal in out of the way places where an ordinary electric or hand drill cannot be used. It is

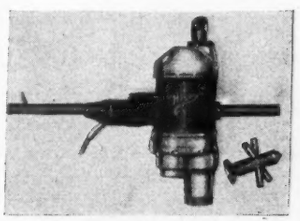


operated through a flexible shaft that may be driven by an electric drill or separate small motor, or it may be belted to a line shaft. Although it is usually furnished in ½-in. capacity it may be had in other sizes with a 1¼-in. screw feed with ratchet handles; the sockets taking Morse taper-shank drills.

Drill, Electric, 1¼-inch

Hisey-Wolf Machine Co., Cincinnati, Ohio.

A No. 3 Morse taper socket is fitted to the drill spindle of this 1¼-in. electric drill which is



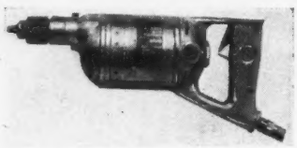
automatically lubricated through the gear case. All pressure applied while drilling is carried by the end handle cover, which is independent of the motor and motor bearings, thus relieving them of all strain. The gear of the armature shaft is removable, and the compound gear shaft is supported in a bearing at each end. The motor, among other features is provided with ball bearings so mounted as to

eliminate all slip and creeping action. Brush-holders with adjustable spring tension are mounted as a separate unit on a Bakelite yoke, thereby permitting brush adjustment when necessary.

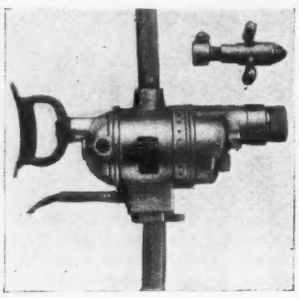
Drills, Electric, Portable

Standard Electric Tool Co., 1938 W. Eighth St., Cincinnati, Ohio

This line of heavy-duty, portable, electric drills is made in two styles and in five sizes



rated at $\frac{5}{16}$ and $\frac{1}{4}$ in. with a grip handle, and at $\frac{3}{4}$, $\frac{7}{8}$ and 1 in. equipped with a Morse taper socket, a spade handle and a feed screw. The housings of

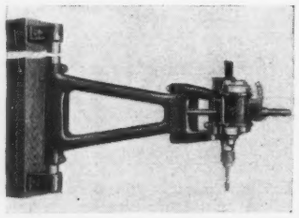


the universal-type, GE motors are made entirely of aluminum. The SKF ball bearings upon which the shafts are mounted, as well as the steel gears, are grease lubricated.

Drilling Arm, Radial

Hisey-Wolf Machine Co., Cincinnati, Ohio.

A double radial arm which can be used on all "Hisey" portable, electric drills up to and including $\frac{7}{8}$-in. capacity. This radial arm is mounted on an inclosed and dustproof ball thrust bearing. By means of individual

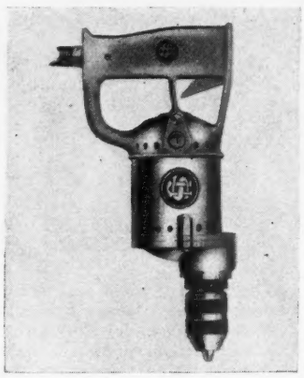


swivel clamps, either the long or short arms can be locked independently. The full arm length will swing to an arc of more than 240 deg. The short arm has an angular adjustment of 245 deg. The maximum arm reach from column to drill spindle is $36\frac{3}{4}$ in. The net weight of this machine is 215 pounds.

Drill, Electric, High-Speed

United States Electrical Tool Co., Cincinnati, Ohio.

Of the two, high-speed, lightweight, $\frac{1}{4}$-in. portable electric drills, one known as the $\frac{1}{4}$-in.

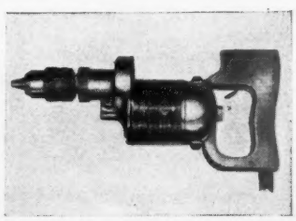


special, direct-drive drill operates direct on the armature shaft at a speed of 10,000 r.p.m. and weighs only 4 lb. The other, known as the $\frac{1}{4}$-in. special gear-reduction drill, operates at 2,000 r.p.m. and is one-eighth of a pound heavier. Both drills embody universal motors equipped with SKF ball bearings. A feature of these drills is their keyless chucks.

Drills, Electric, Portable

Wodack Electric Tool Corporation, 4627-4629 W. Huron St., Chicago, Ill.

This general purpose tool has a capacity of $\frac{3}{8}$ in.; weighs 7 lb., and is powered with a GE universal motor of the latest variable-type controlled by a trigger switch, 100 per cent

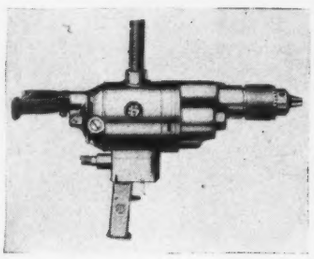


over-size. Besides drilling, it can be used for buffing and grinding. A stand can be furnished for holding the drill vertically and horizontally for grinding and buffing operations.

Drill, Heavy-Duty, Electric, $\frac{3}{4}$-inch

United States Electrical Tool Co., Cincinnati, Ohio.

In all other respects, this low-speed, heavy-duty, $\frac{3}{4}$-in. drill for continuous service is typical of all other U. S. drills. This model weighs 27 lb. and is powered with a universal motor, driving the drill at a speed of



350 r.p.m., load speed. It is provided with a three-jaw screw back chuck for straight shank drill bits.

Heater, Immersion

General Electric Co., Schenectady, N. Y.

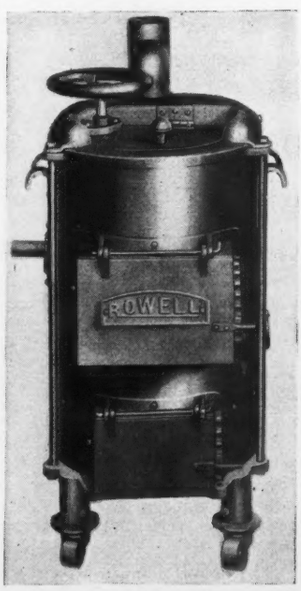
An electric immersion heater intended for low temperature heating of electroplate solutions and other liquids which will not attack lead. The unit consists of a steel-sheathed helicoil unit covered with a lead jacket swaged tightly to the steel unit.

The terminals are brought into a terminal box suitable for conduit connections. These heaters are made in two sizes, and for a maximum demand of 5 kw.; one for 110-volt and the other for 220-volt circuits.

Melting Furnace

Rowell Manufacturing Co., Appleton, Wis.

Designed for melting babbitt and other non-ferrous metals in industrial maintenance departments, this charcoal or gas-fired furnace is equipped with casters

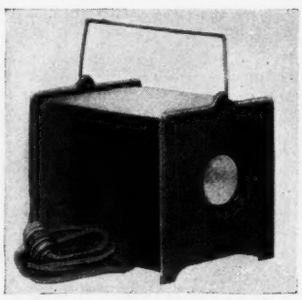


so that it may be moved about as desired and used for either floor or bench work. The melting pot is 9 in. in diameter and 7 in. deep, and has a lead capacity of approximately 120 lb. The body of the furnace is a riveted steel jacket with a 1-in. lining of heat insulation. It measures 29 in. high overall, and occupies a floor space of approximately 20 square inches.

Furnace, Electric

Nabob Electric Co., 274 Madison St., New York, N. Y.

A portable, automatically-controlled, electric furnace with a cylindrical heating chamber in



which a soldering iron or other object not more than $1\frac{13}{16}$ in. in diameter can be quickly heated to the specified temperature. It measures $7\frac{1}{2}$ in. long, 6 in. wide, and $6\frac{1}{2}$ in. high, and weighs approximately 10 lb. The current consumption at 110 volts is approximately 440 watts. The resistance element is wound on a 2-in. diameter round steel tube that forms the heating chamber which is 6 in. deep. The refractory covering for the heating element consists of several layers of mica and an additional layer of porcelain, in which the tube is held in place by two specially molded and baked rings of retort cement.

Furnace, Kerosene-Gasoline

Otto Bernz Co., Inc., Newark, N. J.

The top plate of this furnace is made of malleable iron and is fitted with an attachment for

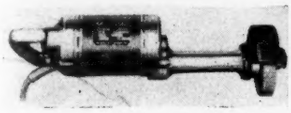
holding soldering irons. The end parts are made of heavy steel rods which reinforce the entire furnace. The pump measures 1 in. in diameter, and is of the patented Never-Leak style. A malleable iron arm extends

from one of the uprights across the furnace to hold the burner shield in place. It has a heavy, seamless-steel reservoir with a capacity of one gallon.

Grinder and Buffer, ½-hp., Portable

Hisey-Wolf Machine Co., Cincinnati, Ohio.

The grinding spindle of this ½-hp. portable grinder and buffer is mounted on roller bear-

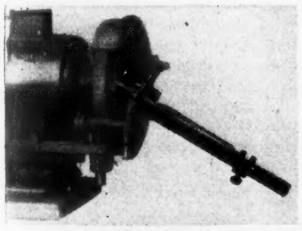


ings. An improved-type "Hisey," two-pole switch controls the universal motor which is also equipped with ball bearings. The grinder comes equipped with a cast-steel wheel guard which is adjustable so that it can be placed at any angle most convenient for the operator. The end cover is removable for replacing grinding wheels.

Twist Drill Grinding Attachment

Standard Electrical Tool Co., Cincinnati, Ohio.

Gages are not required with this attachment which is easily interchanged with the regular



tool-grinding lathe and can be quickly mounted in place, thus giving double service to the tool grinder. It comes equipped with a graduated micrometer screw, the adjustment of which makes the lip-lengths identical.

It is used for grinding either straight or taper-shank twist drills ranging in size from ¼ to 1½ in. diameter, and can be furnished for any Standard Electric Tool Company's grinder having wheels up to 12 in. in diameter.

Grinder, Combination, Bench

Black & Decker Manufacturing Co., Towson, Md.

A combination grinder for buffing, cleaning, and sharpening edged tools. The spindle is driven at 2,400 r.p.m. by a universal, ball-bearing motor for use on 32-, 110-, 220-, or 250-volt circuits. It is furnished complete with a 5-in. grinding wheel on the left spindle and a 6-in., wire-wheel brush on the right spindle. Buffs may be readily interchanged with the wire-wheel brush.

Grinders, High-Frequency

Forbes & Myers, 172 Union St., Worcester, Mass.

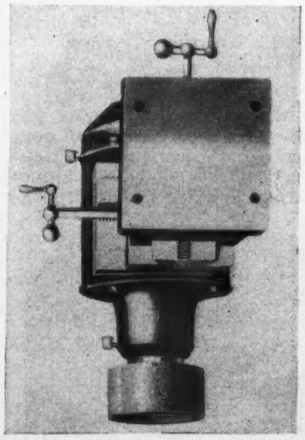
The illustration shows Model No. 204; a double-ended, ¾-hp., 5,400-r.p.m. grinder, which may be equipped with a 3-, or 4-in. wheel for operation on 180-cycle current. The spindle is ¾ in. in diameter at the wheels, and is 23 in. long. Except for slight alterations in the winding, the motor is of the squirrel-cage, induction-type, fully-inclosed, and in appearance like the usual 1,800- or 3,600-r.p.m. induction motor. In addition to this model, the above company is offering similar grinders with

the spindle on one end only, or without the supporting arm. These grinders are made in sizes from ¼ to 2 hp. for any high-frequency current.

Grinder, Vertical Spindle

Hisey-Wolf Machine Co., Cincinnati, Ohio.

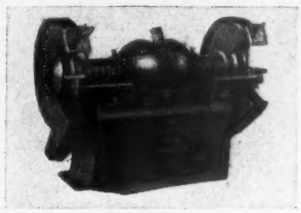
These machines are constructed for thrust grinding with the spindle in horizontal position or with the grinding wheel swung down at any angle. When used in connection with a boring mill many internal and surface grinding jobs can be done with one and the same setting. Three types of vertical spindle grinders are made in 1-, 2- and 5-hp. sizes for a.c. service and in a 3-hp. size for direct current. Vertical, horizontal, and double-slide adjustments may be obtained, also. These vertical spindle grinders can be furnished with a single, horizontal-slide adjustment, and with a single, vertical-slide adjustment.



Grinder, High-Speed

The United States Electrical Tool Co., Cincinnati, Ohio.

This grinder, known as the "U. S. Hi-Speed Snagger," has a speed of 9,500 surface f.p.m. with wheels 30 in. in diameter when operating on 40- or 60-cycle current. The wheel flanges are keyed to the shaft and securely clamped to the

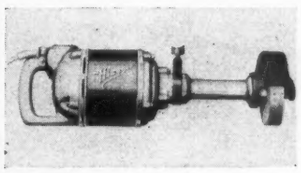


wheels with cap screws. Structural steel safety hoods over the wheels are built for wheel speeds of 10,000 s.f.p.m. The doors on the safety hoods are also fastened on by cap screws. The driving motor is rated at 15 hp. and may be furnished for 220-440-550-volt, two- or three-phase a.c., and for 220-volt d.c. service.

Grinders and Buffers, Portable

Hisey-Wolf Machine Co., Cincinnati, Ohio.

These grinders are available with ball-bearing motors and Timken roller-bearing equipped



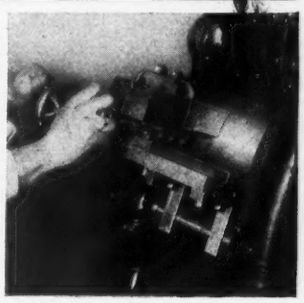
grinding spindles in ½-, 1-, 2-, and 3-hp. capacities. A two-pole switch at the grip handle provides convenient control for the motors which are furnished according to the service. For single-phase service an improved commutating-type, repulsion induction motor is standard equipment. A squirrel-cage motor is used for two and three-phase service, whereas for direct current, a compound-wound motor is provided.

The cast-steel wheel guard is adjustable and can be placed at any angle most convenient for the operator. The end cover is readily removable and affords quick renewal of grinding wheels.

Tool Rest, Commutator, Grinder

Ideal Commutator Dresser Co., Sycamore, Ill.

This device, known as the "Perfect Tool Rest" consists of a portable grinder which is used in conjunction with commutator

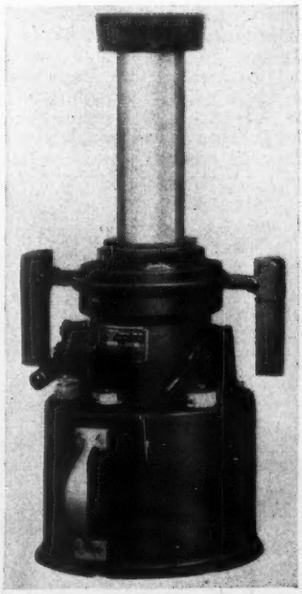


grinding stones or resurfacers in removing long flat spots and any eccentricities in commutators. Bases are available in lengths ranging from 6 to 28 in., in increments of 2-in. Bases 14 in., or shorter have two supports, whereas those 16 in., or longer have three supports. A large diameter wheel facilitates easy operation of the cross-feed. The bases are also provided with a screw infeed adjustment. This tool rest is designed to take cutting stones of 2x2-in. face or smaller, and of any length.

Hydraulic Jack, Seventy-Five Ton

Blackhawk Manufacturing Co., Milwaukee, Wis.

This jack, Model G18, with a capacity of 75 tons, weighs 200 lb., and is equipped with special carrying handles to enable two men to carry it. With a collapsed height of 18 in., it has a 10-in. lift, giving a total height of 28 in. The jack is equipped with two pumps; a feed pump to raise the plunger of the jack to the point of contact, and a power pump to raise the load. The load can be automatically lowered fast or slow, as desired, and under control. An added feature is the check valve unit



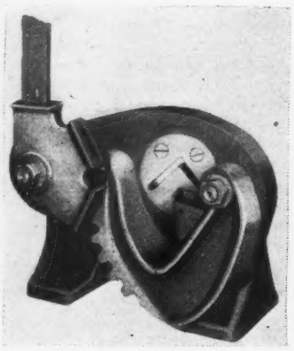
which contains both ball-check valve units.

This "Twin-Check" unit is easily removed for cleaning or inspection by simply unscrewing the pump.

Shear, Angle-Iron

Whitney Metal Tool Co., Rockford, Ill.

Although very similar in appearance and having the same working principle as the No. 4 model manufactured by the above company, this No. 62 unit, however, is a heavier type



capable of handling 3x3¼-in. angle iron. It has an eccentric gear so that the leverage is equally distributed over the entire cutting blade; an adjusting screw to square off all angles, a self-clamping pad for holding angles in position, and a flat bar handle made to fit the socket. Inserted tool-steel blades are used.

Slitting Shear

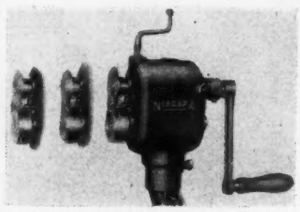
Whitney Metal Tool Co., Rockford, Ill.

This No. 6, roller-bearing slitting shear is made for use on metal up to $\frac{3}{16}$ in. in thickness. Roller-bearings are used on the eccentric crank pin and trunnion bearings. The shear is throatless. The inserted shear blades are 4½ in. long. The lower blade is adjustable for taking up wear.

Bench Machine, Combination,

Niagara Machine & Tool Works, Buffalo, N. Y.

Designed for turning, wiring and burring operations on sheet metal, this heavy combination

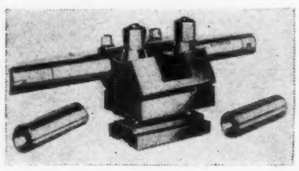


bench machine, known as No. 147-C is arranged with back gearing and will handle soft steel up to 18 gage. It supplements the No. 131-C machine which was designed to handle the lighter gages of metal. It is furnished complete with one pair of burring faces, one pair of turning faces, one pair of wiring faces, a gage, a wrench and a heavy bench stand, or as a single-purpose machine with only one pair of either rolls desired.

Boring Bar, Lathe

Scully Steel & Iron Co., 2364 So. Ashland Ave., Chicago.

In addition to boring and turning, these adjustable boring and turning bars can be used for

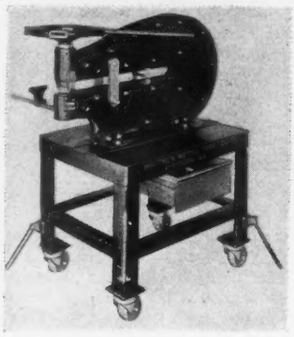


both internal and external threading. The bars are of one-piece construction, and the holders are made so that the bars can be adjusted over a large range. By replacing the holder the largest piece that the lathe will swing can be turned and the bars are always held parallel with the center of the lathe. These bars can be obtained in several different steps, ranging from extremely small tools to very large bars, to fit over tool-posts or into cross-slides.

Punch, Deep Throat

Whitney Metal Tool Co., Rockford Ill.

Both Models, Nos. 26 and 27, are featured by the above company for their throat clearance. The No. 26 punch has an 18-in. throat depth; No. 27 has a 24-in. depth. The capacity of the former is a 2-in. hole through $\frac{3}{32}$-in. thickness of iron, whereas the latter will punch a 2-in. hole through 16-gage iron. Both machines are regularly

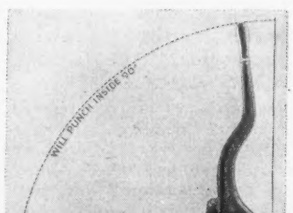


equipped with side tie-rod plates, and when these plates are in position the machines have a capacity of ½-in. hole through $\frac{5}{8}$-in. iron, with 7-in. throat clearance. Handwheels are furnished which are large enough for 80 per cent of the work without the use of a lever. A short lever, however, is furnished with the equipment for punching heavy materials.

Punch, Lever-Type, Metal

Whitney Metal Tool Co., Rockford, Ill.

This lever-type punch, known as No. 7½, is an exact division between the No. 7 and No. 8

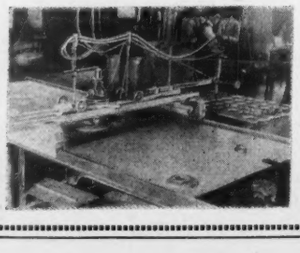


models of the above company's lever-type punches in weight and capacity; which is a ¼-in., hole through $\frac{5}{16}$-in., plate. In common with its companion models, the handle of the No. 7½ punch is arranged for punching standing seams or inside of 90 degrees.

Shape Cutting Machine

Linde Air Products Co., 30 E. 42nd St., New York, N. Y.

In this machine which was designed for cutting shapes of any sort from steel plate, sheet, forgings, billets or ingots, the cutting blowpipe is mounted on



a carriage which is moved in any direction by means of an electric motor. For routine production, however, it will operate automatically from templets. In cases where only a few parts are to be cut out, a hand tracing device can be attached and used to follow the outline of a sketch or blueprint. The cutting speed ranges from 3 to 20 in. per minute, depending on the thickness of the metal. Accurate and smooth cuts can be made in stock up to 1 ft., and more in thickness.

Saw, Electric, Portable

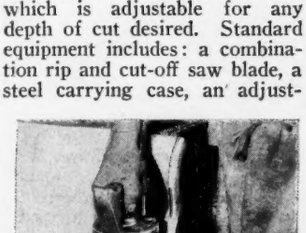
Crowe Manufacturing Corp., 225-9 E. 3rd St., Cincinnati, Ohio

An adjustable depth gage forms part of the safety guard and makes possible any depth of cut up to 4⅛ in. with this electrically-driven, portable saw, known as the Type CC, which is powered with a G.E. universal motor suitable for operation on 110- or 220-volt circuits. The saw is equipped throughout with heavy-duty ball bearings.

Saw, Light-Weight, Electric

Skilsaw, Inc., 3814-24 Ravenswood Ave., Chicago, Ill.

Designated by the letter J, this model which weighs but 11 lb., can be used for cutting dressed lumber up to 2 in. in thickness with a saw blade 6 in., in diameter. A kerf guide and an approved safety guard are built into the frame, the base of which is adjustable for any depth of cut desired. Standard equipment includes: a combination rip and cut-off saw blade, a steel carrying case, an adjust-

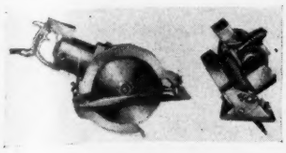


able rip fence attachment, 15 ft., of rubber-covered cord with connections, a tube of Skilsaw lubricant, and a socket wrench.

Handsaw, Electric

Wodack Electric Tool Corporation, 4627-4629 W. Huron St., Chicago, Ill.

One of the features of this Type B portable, electric handsaw is that it can be used for bevel sawing at any angle up to 60 deg. This is accomplished by a tilting saw base that can be



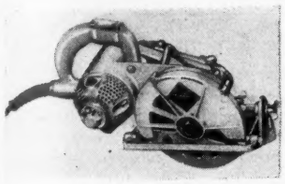
set and locked at any angle within the above range by means of a slide and locknut.

One other feature which adds to its value is the coupling that connects the motor with the worm drive. In case the saw blade should get caught and held in the lumber, the safety coupling will release the motor, thus insuring it against damage. It is driven with a universal motor which can be furnished for operation at 110, 220 or 250 volts.

Handsaw, Electric

Wappat Gear Works, Inc., 7522-26 Meade St., Pittsburgh, Pa.

All three models of this small, electrically-driven handsaw have a cutting capacity of 2 in., and



come equipped with a safety guard, an exclusive patented feature, which completely incloses the saw blade; opens gradually by telescoping into the upper guard as the saw is pushed into the material, and immediately snaps shut as the cut is finished, thus affording protection to the operator and the saw blade.

Of the three models; one is built for plain square cutting, one for bevel cutting, and one with an adjustable dado cutter for grooving.

The shoe, in all three models, is adjustable vertically, making it possible to set the saw to cut to any required length or depth. The saw shaft which is mounted on roller bearings is driven by a universal motor through helical gears which are mounted on ball bearings, all completely inclosed and running in grease.

Timber Saw, Motor-Driven, Portable

Reed - Prentice Corporation, Worcester, Mass.

This device, known as the "Wolf" portable, timber-sawing machine consists of four pieces of special saw steel, heat-treated and riveted together with a slot around the edge providing a track for the saw links to travel. The motor or driving apparatus is located on one end of the frame which is held rigidly in position at all times by four steel pins and two spiders connecting with the drive end. An eccentric on the sprocket shaft provides adjustment for tension on the chain. The link pins are stationary in the cutter teeth and the raker teeth pivot on steel bushings.

The strength of the chain in relation to the pull of the electric-, or the air-driven motor which is supplied with the saw, gives a very liberal safety fac-

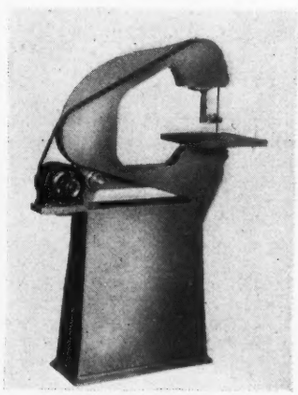
tor, although a shear pin on the sprocket shaft protects the machine from sudden shocks or strains.

A foot-control switch housed in a composition aluminum and copper casting, is provided for a.c. service whereas on air and d.c. service, the control is mounted on the motor end of the saw.

Bandsaw, Portable

DeWalt Products Co., Leola, Pa.

By means of three tracking pulleys instead of two large pulleys to separate the two sections of a revolving saw blade, this portable bandsaw; a compact machine with a 20-in. clearance between the saw blade and the

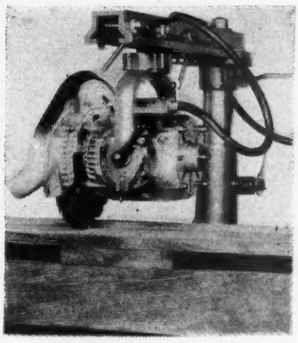


frame, can handle material up to 7 in. in thickness. Although, it is preferably used as an individual motor-driven unit equipped with motor and floor stand, it can be used, however, independent of both.

Saw, Portable, Electric

DeWalt Products Co., Leola, Pa.

This portable, motor-driven saw, known as the "Wonder Worker" comes fitted on a handy, wooden table which can be placed upon wooden horses or on a small truck to move



about the plant. It is direct driven and may be powered with 110-220 volt a.c. or d.c. motors of from 1 to 8 hp. in capacity, and it will handle material up to 6 in. in thickness and 24 in. in width.

The saw can be swung to any angle, right or left, raised or lowered, or tilted for compound angles.

Rule, Flexible Steel

Hiram A. Farrand, Berlin, N. H.

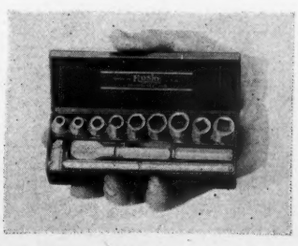
The Farrand "Rapid Rule" is a single piece of nickel steel, 6 ft. in length, possessing both

stiffness and flexibility. Because of its unique structure it offers resistance to bending up to a certain amount of stress, after which it yields readily. This alternation from a relatively rigid state to an elastic one takes place all at once, following which the rule can be run into a coil with ease. As a result, it can be carried in a specially devised holder which is a little larger than a watch. The rule can be bent at will without injury, so long as it is not bent beyond its natural arc of 1 in. in diameter.

Wrench Set, Socket

Husky Wrench Co., Milwaukee, Wis.

This set, known as the "Baby," is designed for bolts and nuts as are found on small machines,



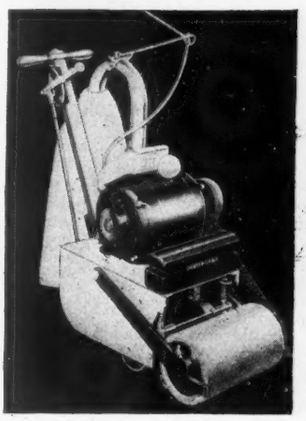
instruments and on electrical equipment. Socket sizes are: $\frac{5}{32}$, $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{11}{32}$, $\frac{3}{8}$ and $\frac{7}{16}$ in. hex. and $\frac{1}{4}$ and $\frac{7}{16}$ in. square.

The combination tee has a self-locking head and a 5-in. handle. The speed screwdriver, which can be used for extension, is $4\frac{1}{2}$ in. long and has a swivel grip for speed. All parts are nickel-plated and burnished.

Floor Surfacer, "Speedmatic"

Porter - Cable Machine Co., Syracuse, N. Y.

In this machine, designated as the "Speedmatic," a drum 12 in wide and $6\frac{3}{4}$ in. in diameter car-



ries the abrasive paper and is driven at a speed of 1,150 r.p.m. (2,000 f.p.m. surface speed) by a $1\frac{1}{2}$-hp., 1,800-r.p.m. single-phase motor. A direct-current motor will be supplied if desired.

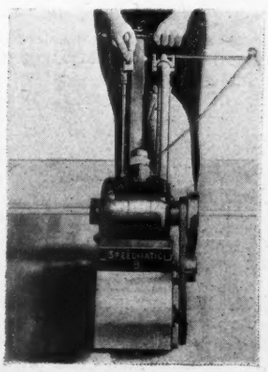
A 7-in. fan driven at 5,000 r.p.m. creates the vacuum for the dust collecting equipment.

Floor Surfacer, "Speedmatic Eight"

Porter - Cable Machine Co., Syracuse, N. Y.

Although much smaller in size, this floor sander, known as the "Speedmatic Eight," has been built along the lines of the larger, heavier-duty Type S-12.

Despite the light weight, great pressure can be applied to

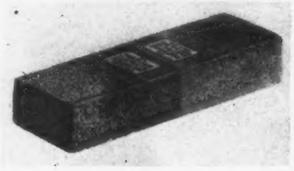


the small 8-in. diameter drum which is featured to insure intensive cutting. The machine is equipped with a 1-hp., G.E. motor and its overall dimensions are 13¼ in. wide, 31 in. long, and 34 in. high. The net weight is 158 pounds.

Commutator Stones, Double-Duty

Martindale Electric Co., 1252 W. Fourth St., Cleveland, Ohio.

One end of these double-duty stones which are furnished in various sizes convenient for

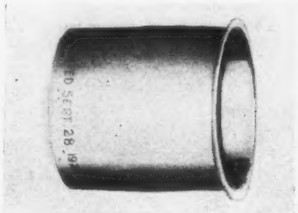


carrying in the pocket or tool kit, is made from this company's coarse (cutting) grade, and the other end from its fine (finishing) grade of abrasive material.

Pipe Savers

Pipe - Saver Corporation of America, Carthage, N. Y.

A device that is made to fit snugly inside the ends of pipe of any standard size, and which



consists of a piece of tubular metal made of an alloy that is practically impervious to the action of pipe material. A flange covers the extreme end of the pipe and curves into the coupling, so that the pipe ends are completely reinforced by the Pipe Saver lining.

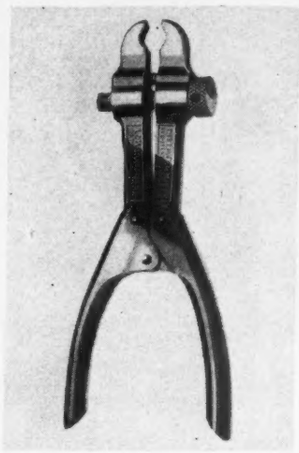
After the pipe is reamed, as all pipe should be before installation, a Pipe Saver is dipped in oil and then inserted in the end of the pipe and seated by placing a block of wood flat against the flange and striking it with a hammer.

Pliers

Lawson Manufacturing Co., Cleveland, Ohio.

A tool which takes its name "Lok-Jaw" from the arrangement whereby the jaws may be locked to nuts, bolts, and other objects in the manner of a hand vise.

Designed to fit round, square, or hexagon objects, these pliers,



may be clamped to a loose nut or bolt head in an inaccessible place, and so keep the nuts or bolts from turning while it is being loosened or tightened with a screw driver or wrench. In the size illustrated, the 8-in., the maximum jaw opening is ¾ inch.

Disk Sander

United States Electrical Tool Co., Cincinnati, Ohio.

This device consists of a 9-in. disk, which is driven at 3,600 r.p.m. under load by a fan-cooled universal motor. Ball bearings are used throughout and a two-pole trigger switch is located in the handle to control the motor.

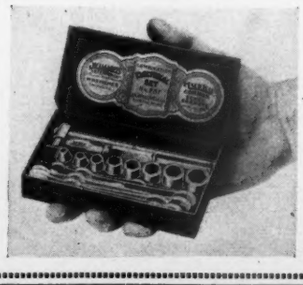
Fine, medium and coarse sanding disks are furnished as standard equipment, including also, 12 ft. of flexible rubber-covered cable, a two-tree attachment plug, and an armored cable guard. The total weight of the machine is 12 pounds.

Wrench Set, Combination

J. H. Williams & Co., Buffalo, N. Y., & The Husky Wrench Co., Milwaukee, Wis.

A combination wrench set, known as the "Williams-Husky Electrical Set," No. 287, contains a complete assortment combining open-end and socket wrenches to service the electrical equipment in general electrical work.

The set contains seven Williams Midget "Superrenches" in sizes; 5/32, ¼, 5/16, 11/32, 3/8, 7/16, and ½ in., each wrench having two



openings of the same size—but at different angles.

The Husky wrenches included in the set are eight "Baby" sockets tapered for work in close quarters in sizes; 5/32, 3/16, ¼, 5/16, 11/32, 3/8, 7/16, and ½ in., in addition to a 5-in. combination Tee and a 4½-in. handy grip. The set packed in a metal box weighs 1½ pounds.

Valve Stem Guide Cleaner

Scully Steel & Iron Co., Chicago, Ill.

Although this cleaner is exactly the same in design as the well known "Ruggles Perfection" Flue Cleaner which has been used for twenty-five years for removing carbon from boiler tubes in steam plants, it is intended for internal-combustion

engine, valve-stem guides. Only three cleaners are required for all holes from 5/16 to ⅝ in., in size. In using this cleaner no turning is required, inasmuch as it is simply worked straight up and down.

Pencil, "Multi-Vider"

Ruxton Multi-Vider Corporation, 2445 Graybar Bldg., New York, N. Y.

The "Multi-Vider" pencil is a combination slide rule and automatic pencil with which rapid

calculations can be made involving multiplication, division, percentages and proportions with sufficient accuracy for estimation purposes, and the result can be written down with the pencil in hand.

Its overall length is 6½ in., and it measures 7/16 in., across the flats of the hexagon barrel so that it can be readily carried in the vest pocket.

The hexagonal spiral carrying the scales, of which there are four; one a logarithmic scale 4 in. long is made of Bakelite for lightness and durability and is split in half. The two halves slide in relation to one another by means of a metallic strip and groove on the inside of the hollow hexagon halves. It is only necessary to roll the pencil while held in the fingers to obtain readings on either sets of scales.

Pipe Wrench

Trimont Manufacturing Co., Inc., 55 Amory Ave., Boston, Mass.

Although the contour of the frame has been slightly extended, the appearance of this "Trimo" wrench remains practically unchanged, and the parts of the old and new wrench are interchangeable throughout.

The swinging steel frame, though not materially changed

in appearance, has been strengthened to such a degree that breaking is considerably reduced under the most trying conditions.

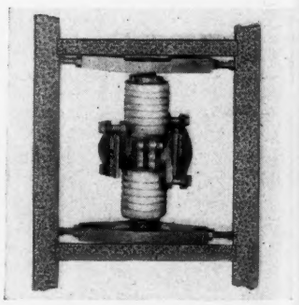
As a further safeguard, overlapping side lugs, an integral part of the handle, places the frame effectively against the lateral distortion or spreading. The design of these reinforcing lugs furnishes a rugged safety feature without hampering in any way the action of the frame.

Switchboard Equipment

Bus Supports

General Electric Co., Schenectady, N. Y.

Installation of this bus support is a comparatively simple matter as it is mechanically ex-



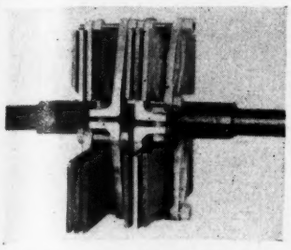
panded against the sides, top and bottom of the compartment in which it is located. It consists essentially of a cylindrical bushing with expansion elements at either end and a connection clamp over the middle.

The expansion element is a pipe nipple with a stationary flange and movable locknut. Vertical expansion is accomplished by unscrewing the locknut against the bushing until the assembled unit bears rigidly against the top and bottom shelves. A screw and locknut at either end of the stationary flange provide for horizontal expansion.

Bus Supports

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

These supports, known as the modified hollow square type, consist of heat-treated alumi-



num alloy clamps insulated from the standard 1¼-in. pipe of the mounting support by Micarta tubes. The support is designed for 4x½-in. busbars, and for a maximum of 4,000 volts.

The supports may be adjusted to carry from one to twelve bars. This feature allows the bus to be tapered as feeders are tapped off, and facilitates installation of additional bus copper. The hollow square arrangement of bars minimizes the effect of both skin and proximity effect and permits working the copper at its maximum efficiency.

Bus Supports

Delta-Star Electric Co., 2400 Block Fulton St., Chicago, Ill.

These supports have been designed to carry 220/4,500-volt buses for industrial wiring.

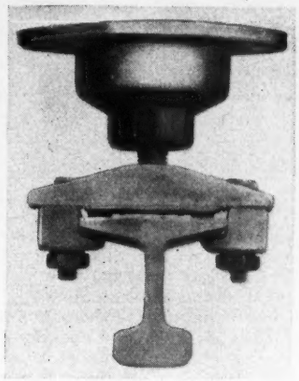
The insulators are wet process porcelain with a dark brown glaze and have smooth sides, instead of the conventional corrugated surfaces. The dry flashover point is at 38,000 volts. The ultimate tensile strength is 3,000 lb. and the ultimate cantilever strength, applied 1 in. above the top of the insulator, is 1,160 pounds.

Crane Rail Supports

Delta-Star Electric Co., 2400 Block Fulton St., Chicago, Ill.

This insulating unit consists of a cup-shaped porcelain member held between an outside fitting and the mushroom head of the rail-supporting bolts. Tension is distributed uniformly over the porcelain cup by washers on the outside of the cup. A molded insulating disc, with a compound seal, over the washer and bolt assembly protects the assembly from moisture and cushions the porcelain against abnormal impacts.

The lugs and clamp faces have notched surfaces fitting into each other and so spaced

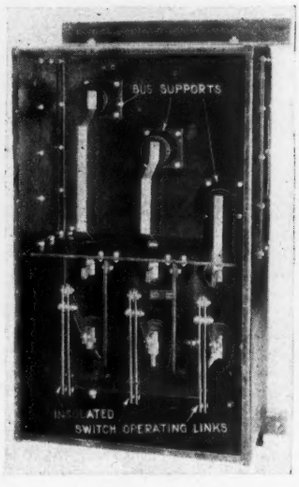


that by moving the lugs one notch in or out they fit the next size smaller or larger rail.

Distribution Center

Delta-Star Electric Co., 2400 Block Fulton St., Chicago, Ill.

Designed for 2,200-volt service, this industrial distribution center is constructed on the order of a sectional bookcase, using for each motor one steel box containing three standard 7,500-volt bus supports and three 7,500-volt, single-pole disconnect switches. The latter are provided with vertical Transite



barriers. The disconnects are gang operated by an insulated handle on the front of the box and can be locked in or out.

Instrument Panel, Boiler Room

The Hays Corporation, Michigan City, Ind.

This panel consists of a U-shaped plate of ¼-in. boiler steel with a metal enclosure for the top and hinged steel doors at the rear. The valves, pipe, and wiring for the different in-

struments are easily accessible through these doors, which serve to protect and conceal them from view. If desired, these panels can be furnished with a slate front, instead of steel.

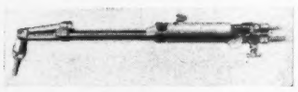
The cases which enclose the Hays recorder and the steam pressure, temperature, and other gages, have been designed so that they may be mounted flush or semi-flush.

Welding Equipment

Blowpipe, Cutting

Oxweld Acetylene Co., 30 East 42nd St., New York, N. Y.

Using the same nozzles as the Oxweld Type C-2, which it resembles, several improvements



in design have been made in the Type C-4 blowpipe. The three gas tubes are straight, having no bends either outside or inside the handle. The cutting valve is of the same design that is now used on all hand cutting blowpipes made by this company.

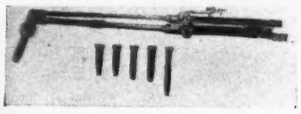
The small needle valve body and both the head and the rear body of the Type C-4 blowpipe are pressure forgings instead of castings.

Interchangeable nozzles are provided so that this blowpipe may be used with either medium- or low-pressure acetylene.

Torch, Combination, Cutting and Welding

The Alexander Milburn Co., 1420 W. Baltimore St., Baltimore, Md.

It is unnecessary to use two torches, or to disconnect the hose from the torch valve in order to change from cutting to welding, when the Type RI torch is used. This torch can be used for either purpose by merely interchanging the tips. It has been designed for opera-



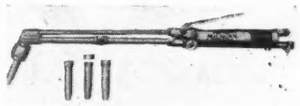
tion with oxygen and acetylene, oxygen and hydrogen, or other gases.

Other important features claimed for this combination torch are that it has only two gas tubes; the high-pressure cutting oxygen thumb button remains fixed in either the open or closed position; and the forged bronze torch head and valves have a tensile strength of 60,000 lb. per sq.in.

Torch, Combination Cutting and Welding

The Alexander Milburn Co., 1416-28 W. Baltimore St., Baltimore, Md.

With the Type TI combination cutting and welding torch, changing of tips is not neces-



sary when changing from cutting to welding. The tip can be changed from one form to the other by merely turning it.

In one position the gases are automatically passed through the pre-heating passages, while the high-pressure oxygen is carried through the central hole for heating. In the next position, reached by a quarter turn of the tip, the cutting oxygen is shut off and the welding gases are conveyed through the central passage of the cutting tip.

Arc Welding, Automatic Control

General Electric Co., Schenectady, N. Y.

An improvement in the control equipment used with the automatic arc welding head, by means of which the feed of electrode wire is stopped before shutting off current at the end of the weld, accomplishes two purposes: First, it clears the electrode from the weld; second, it fills in the crater which

is left at the end of the weld when the arc is cut off.

The control panel for the automatic welding head is controlled by a start and stop push button station.

Electrodes, Welding

Fusion Welding Corporation, 103rd St., and Torrence Ave., Chicago, Ill.

On account of their color, these mild-steel welding electrodes will be designated in the trade as Blue Streak and Yellow Jacket, respectively.

The Blue Streak is a fast-flowing electrode that is especially suited to the welding of the medium and lighter gage plates and sheets.

The Yellow Jacket is a surfaced electrode that is designed to give extreme penetration when used with high current on heavy material.

Electrode, Welding

The Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio

This welding rod, which is known as Fleet-weld, has been designed to produce a dense weld of great ductility at considerably increased speed.

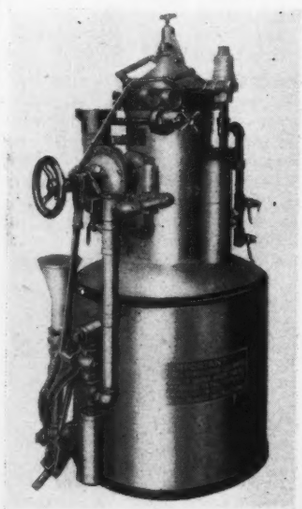
An incidental advantage which the new electrode offers is the smooth finish of its head. This is caused in part by the higher speed of travel allowed by the new rod and is also due in part to its composition.

Generators, Acetylene

Oxweld Acetylene Co., 30 East 42nd Street, New York, N. Y.

The Type MP-2 medium-pressure acetylene generator is built in two sizes having 50-lb. and 100-lb. carbide capacity respectively, and replaces an earlier model.

The Type MP-3 generator has a 300-lb. carbide capacity.

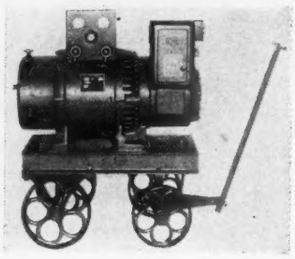


These generators are suitable for supplying pressure-type or medium-pressure welding and cutting blowpipes.

Welder, Motor-Driven Arc

Fusion Welding Corporation, 103rd St., and Torrence Ave., Chicago, Ill.

A d.c. welding generator driven by a three-phase, 220- or 440-volt a.c. motor. Welding gen-

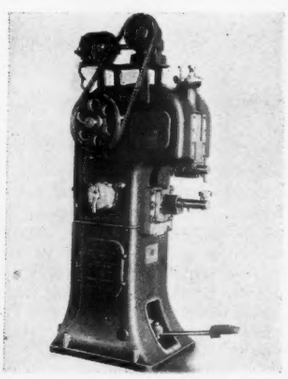


erator and motor are mounted on the same shaft. The arc is described as flexible, is said to present unusual stability and to respond instantaneously to changes in arc length. There is no external stabilizer, no field rheostat nor separate exciter. One control governs the welding current, a brush-shifting device which gives a range from 500 to 300 amperes.

Press, Electric Welding

Gibb Welding Machine Co., Bay City, Mich.

A combination of an automatic spot welder and a punch press.

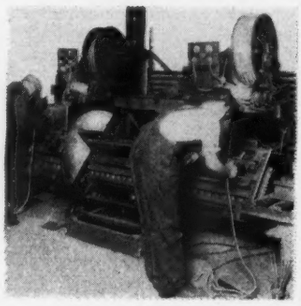


Spots are made in 0.01 sec. on account of a specially designed transformer and a precisely timed automatic switch. The weld is made before the heat provided by the condenser-like discharge of a transformer has an opportunity to soften the outer surfaces of the sheet. It is said that depressions in the surface, warpage and discoloration are eliminated.

Welder, Metal Tie

General Electric Co., Schenectady, N. Y.

This automatic welding equipment for making metal railroad ties from scrap rails, consists



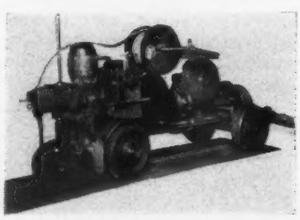
of an automatic tie welding machine, and a 1,500-amp. motor-generator set with two circuits for hand welding and two circuits for automatic welding.

For maximum production the machine requires two operators, one for each of the two automatic heads. Each head has a separate control panel, thus making each operator independent of the other. The estimated output of the machine with two operators is one tie every five minutes.

Welder, Automatic

The Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio

Designed for making lap and butt welds on large tank bottoms, roofs, large pipes and



similar work, this automatic, tractor-type arc welder utilizes the electronic tornado principle. Power is supplied through a flexible cable and it is only necessary to line up the machine over the seam to be welded and start the arc; the electrode and fibrous autogenizer are fed automatically as the tractor travels forward.

The chief advantages claimed for this machine are high welding speeds and smooth, uniform welds. It is claimed that on ¼-in. lap joints speeds varying from 50 to 75 ft. per hour are obtained.

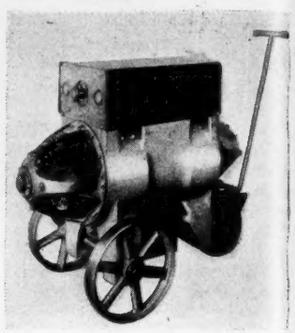
Arc Welder, Heavy-Duty

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

This 300-amp, d.c. arc welding unit has been designed and constructed for heavy-duty work where only direct current is available.

The driving motor and generator are inclosed in the same frame and are mounted on a common shaft with a ball bearing at each end. For use as a portable unit three roller-bearing wheels are attached to the frame.

The generator which is a



single-operator, constant-current, differentially-compound-wound type, is separately excited from the motor supply, and has a welding range of 75 to 400 amp.

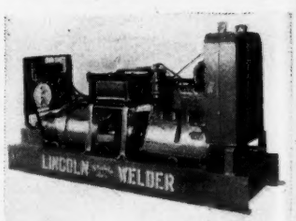
Arc Welder, Engine Driven

The Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio.

Known as Model S-1960, this unit has a rating of 200 amp., according to N.E.M.A., standards, with a current range for welding duty of 50 to 300 amp. It operates at a speed of 1,500 r.p.m. and motive power is provided by a four-cylinder, Type H-9 Continental Red Seal engine.

The welding generator and engine are mounted on a welded structural base. The unit weighs only 1,580 lb., and is 76 in. long by 25 in. wide.

A steel switchboard is pro-

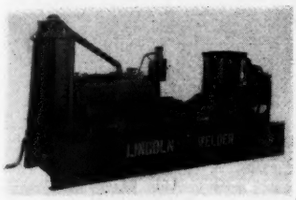


vided in place of the usual slate or composition board, thereby reducing the possibility of damage in the field.

Arc Welder, Engine Driven

The Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio.

The generator is rated at 300 amp., in accordance with N.E.M.A., standards, and has a current range of 75 to 400 amp., for metallic electrode welding. It is direct connected to a six-cylinder Buda, Model HS-6 engine operating at 1,500 r.p.m. Both units are mounted on a welded-steel base.



The engine has an S.A.E. rating of 27.3 hp. and gives a brake-horsepower of 41 while running at the operating speed.

The generator has the laminated magnetic circuit with separately excited fields, stabilizer, variable-voltage and steel-construction features characteristic of this company's line of Stable Arc Welders.

Arc Welder, Tractor Mounted

General Electric Co., Schenectady, N. Y.

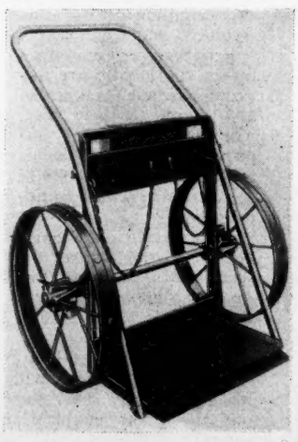
This outfit consists essentially of a standard Fordson tractor, with a belt-connected, Type

WD-300-A, 25-volt, 300-amp., one-hour rated, 1,750-r.p.m. ball-bearing generator, mounted on the tractor and protected by a metal canopy and canvas side curtains. Standard equipment includes head and tail lights, battery and charging control, and industrial (disc-type) rubber-tired wheels in front and rear. If desired light industrial (spoke-type) wheels or standard Fordson farm wheels for front and rear may be had.

Truck, Gas Welding Equipment

Oxweld Acetylene Co., 30 East 42nd St., New York, N. Y.

Increase in wheel size was a primary consideration in the design of this truck for carrying gas cylinders and welding equipment. This model is equipped



with 24-in. steel wheels having 3x$\frac{3}{4}$-in., grooved tires and a cast-iron hub. The hub is bored to fit the cold-rolled steel axle and provided with a grease cup.

The handle is continuous, with the upper portion bent back about 8 in. so that the truck can easily be handled by an operator of small stature.

If 24-in. wheels are not required, 14-in. wheels may readily be used instead.

Wiring Accessories

Trolley Tap

Ohio Brass Co., Mansfield, Ohio.

In this trolley tap the number of parts has been reduced to a minimum and special attention

has been paid to the safety features. These include protective hand guards that greatly reduce the likelihood of accidental contact with the live hook.

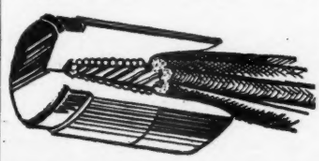
Dowel pins on each terminal fit in a groove that runs the length of the holder; terminals and fuse element are thus kept from turning or twisting inside the case.

This tap is equipped with a renewable, powder-packed fuse.

Connector, Wire

Ideal Commutator Dresser Co., Sycamore, Ill.

This is a solderless, tapeless wire connector, consisting of a copper-coated tapered steel



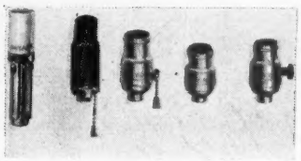
spring with a carrying capacity equal to the wires to be joined, mounted in a cold-molded-insulation crown. The crown has a minimum thickness of $\frac{1}{4}$ in. and is tested to 10,000 volts. The connector threads on the wires and makes a positive contact between them, acting as a current-carrying sleeve.

These connectors are made in two sizes, the first size (black) is designed for use on all common wiring joints consisting of two No. 18 wires to four No. 14 wires. The larger size connector (brown) will accommodate joints consisting of four No. 14 wires to three No. 10 wires.

Wiring Devices

The Bryant Electric Co., Bridgeport, Conn.

The Intermediate line of wiring devices has been produced to fit the new S-11 bulb lamp. Sock-

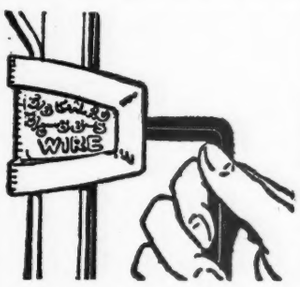


ets with Intermediate screw shells can now be secured in the following styles: Brass shell, key, keyless and pull sockets; composition candle pull sockets; Templus pendant weather-proof sockets; porcelain keyless candle sockets; and sign receptacles.

Clamp, Grounding Wire

Copperweld Steel Co., Glassport, Pa.

This clamp, listed as standard by the Underwriters' Laboratories, is designed to encircle the ground rod and securely bind the grounding wire directly to it. No soldering is required,



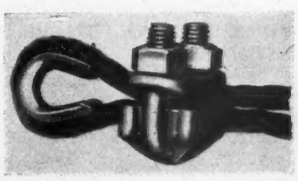
the installation consisting simply in passing the grounding wire into the clamp which has been placed around the driven rod and then tightening by means of a setscrew.

It is said that the wire is clamped so securely to the rod that is is flattened against it, thus increasing the contact surface and minimizing the possibility of slippage.

Clip, Cable

Eureka Metal Products Corporation, North East, Pa.

Made in a full range of sizes this clip has, it is claimed, shown by actual test its ability



to carry three times the maximum load of an ordinary clip, and to give equally good results on wire rope and messenger strand.

Among the features is a larger holding surface which minimizes the wear and tear on cables as there is no distortion. The large surfaces on both the top and bottom plate are grooved for the lay of the cables, so that neither of the cables is gripped by the U-bolt.

Conduit, Flat Metallic

Wiremold Co., Hartford, Conn.

The Master size Wiremold which, together with its fittings, is designated as the 1,000 series, has been designed to increase the adaptability of the Wiremold system in factories, stores, and office buildings, and other installations of this character.

The Master size Wiremold is designed for use with heavy-duty industrial and commercial wiring circuits where ease of installation must be combined with absolute protection, safety and conformity to Underwriters' requirements.

Fitting, Entrance

Chicago-Jefferson Fuse & Electric Co., 1500 So. Laflin St., Chicago, Ill.

Ease of assembly, maximum wiring space and only one locking screw are features that distinguish the Type MF Gem Powerlet service entrance fitting.

In assembling, the base is screwed onto the conduit. When the cap is removed the wires can be pulled through the conduits by a straight pull. The wires are then passed through the cover and the cap replaced.

The cap is designed to be mounted in either the vertical or horizontal position.

Fuse Puller

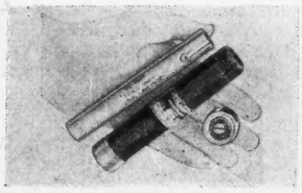
Trico Manufacturing Co., Milwaukee, Wis.

This little tool, which is made of genuine horn fiber, is 5 in. long and has gripping jaws on one end for handling cartridge fuses $\frac{1}{4}$ in. to $\frac{1}{2}$ in. in diameter. The other end terminates in a screw driver suitable for use on the small screws found on electric sockets, plugs, and the like.

Fuses, Renewable

Trico Fuse Manufacturing Co., Milwaukee, Wis.

According to the manufacturer, this improved fuse reduces the time heretofore spent renewing



elements. All small parts have been eliminated. This is accomplished by using spring retainers on the end caps to hold the end screws. The fuse consists of only two parts and the renewal element. The removal of only one cap is necessary when renewing.

Fuse Links

W. N. Matthews Corporation, St. Louis, Mo.

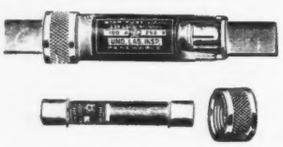
These fast-blowing fuse links are said to have a minimum fusing current of 115 per cent.

It is claimed that they will carry rated current indefinitely without heating the fuse cartridge beyond 210 deg. F., but when subjected to a current 11 per cent above normal, they will melt in a period ranging from two to twelve minutes, depending on the fuse size. The small fuses melt in the shorter period.

Fuse, Renewable

Star Fuse Co., Inc., 235 Canal St., New York, N. Y.

Simplicity of construction and ease of assembly without the use of tools characterizes this



redesigned line of fuses. The renewable element is enclosed in a fiber tube that collects all the molten material and sediment, thus leaving the inside of the case clean after each blowout.

The method of construction also makes it impossible to place two refills in the same case.

Fuse, Plug

Trico Fuse Manufacturing Co., Milwaukee, Wis.

These plug fuses are colored according to a practical scheme that has been worked out by the manufacturer.

A distinctive color is used for each size of fuse as follows: 0 to 6 amp., brown; 10 amp., yellow; 15 amp., blue; 20 amp., pink; 25 amp., red; 30 amp., green.

Plug Cap Puller

Ren Manufacturing Co., 550 Main St., Winchester, Mass.

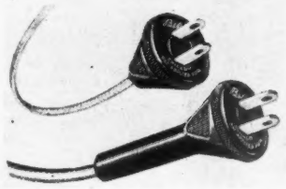
An attachment known as the Pull-A-Plug designed to be fastened onto standard plug caps to provide a grip for the fingers when disengaging the caps.

This device is slipped over the plug cap and fastened by tightening a screw. The two curved arms form convenient grips for the fingers, and also serve as a shield to protect the cap.

Plug, Soft Rubber

Belden Manufacturing Co., 2300 So. Western Ave., Chicago.

Solid, soft-rubber construction enables this plug to stand a great deal of punishment. It is



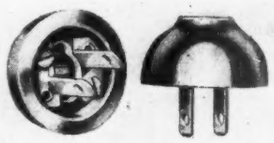
shaped to form a convenient grip for the fingers when plugging in or pulling it out, and is manufactured in several different shapes for a wide variety of uses.

This plug is sold only as part of the Belden cord service, and is furnished attached to this company's many varieties of cords. Cords with the plug attached are furnished in 10-, 20-, and 50-ft. lengths.

Plug Caps, Non-breakable

The Cutler-Hammer Manufacturing Co., 199 Twelfth St., Milwaukee, Wis.

In this plug cap, which is made of rubber, the terminals are fastened in a Bakelite strip em-



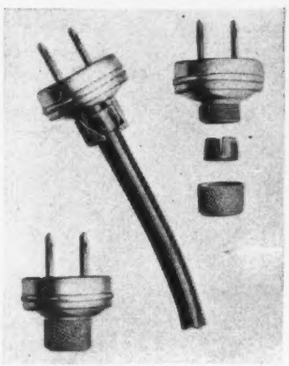
bedded in the rubber base. Rivet and anchor construction hold the terminals to the Bakelite and keep them from turning. Staked screws prevent loss and save time in wiring.

When the plug is used with rubber cord, a bit of ordinary rubber cement placed between the cord and plug will hold them firmly and permanently together and thus serve to relieve strains.

Plug Cap, Cord Grip

The Cutler-Hammer Manufacturing Co., 199 Twelfth St., Milwaukee, Wis.

Embodying an improved type of cord grip, this non-breakable attachment plug cap, which is identical with the Dreadnaught



line of caps made by this company, has been designed particularly to lessen short-circuit hazards. To fasten the cord grip it is only necessary to screw down a knurled threaded collar.

The knurled collar wedges a fiber bushing tightly against the cord, and serves to insulate the cord from the metal parts. This bushing is the only part that actually touches the cord.

Sheet Bakelite is used to hold the blades firmly in place.

Switch, Surface, Expulsion-Type

The Bryant Electric Co., Bridgeport, Conn.

Designed especially for handling inductive loads and for controlling three-phase, a.c. motors

up to 2 hp. rating, this switch is reversible, triple pole, and is rated 20 amp. at 250 volts, and 10 amp. at 600 volts.

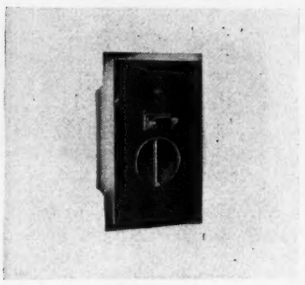
A composition base and handle are used, the latter indicating the position of the switch. The insulating disks are made of a laminated phenolic composition. The switch blades are of heavy phosphor bronze, engaging with brass contacts.

Three types of covers are available, designed for use with various makes of conduit fittings, and for different conditions of service.

Switch and Outlet

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y.

Combining a tumbler switch and convenience outlet, this device has been designed to fit any standard gang-switch outlet box



and is intended for use in places where a switch is needed to control a light, with an outlet to accommodate an electrically-operated appliance.

The tumbler switch controls the lighting fixture, whereas the convenience outlet is wired separately so that current is always available.

Switches, Entrance

The Trumbull Electric & Manufacturing Co., Plainville, Conn.

Having reversible endplates and available in two- or three-pole types, 30-amp., 125-volt rating, these two entrance switches may be used with or without meters as desired.

The top ends contain conduit knock-outs, one for use with standard 15-amp., meters, and a twist-out for attaching special, hood-type meter trims required in certain localities. When these are to be used it is necessary merely to remove two screws and reverse the top endplate. The large twist-out is then removed allowing the special meter trim to slide into place.

Follow the Equipment News Each Month

THE preceding descriptions bring you up-to-date on equipment, referred to on the opening page of the issue as "What to Do It With." Essential specifications of 1928 equipment are thus presented under one cover.

Progressive manufacturers continually are improving their equipment and adding to their lines. The details of such improvements and additions are presented each month as current news of equipment.

Progressive plant engineers will not neglect the section of *Industrial Engineering* appearing under the heading "New Equipment." Knowledge of equipment can make all the difference in the world in successfully carrying out the plant engineer's job.

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INDUSTRIAL ENGINEERING
Electrical, Mechanical and Plant Service in Industry
L. C. MORROW, *Editor*

New York, January, 1929

Volume Eighty-Seven

WITH this issue begins Volume 87 of INDUSTRIAL ENGINEERING, which is a consolidation of *Electrical Review, Western Electrician,* and *Industry Illustrated.*

Electrical Review was founded in 1822 under the name of *Review of the Telephone and Telegraph,* with George Worthington as editor. Mr. Worthington was succeeded by Charles W. Price.

Western Electrician, published in Chicago, Ill., was merged with *Electrical Review* in 1908; *Electrocraft,* a monthly, published in Detroit, Mich., was absorbed in 1912, and *Electrical Engineering,* a New York publication in 1928.

Electrical Review was purchased by the McGraw-Hill Publishing Company in 1922, and the name was changed to *Electrical Review and Industrial Engineer.* This name was later changed to *Industrial Engineer* and subsequently to *Industrial Engineering.* D. H. Braymer became editor in 1922, and his duties were taken over in 1926 by G. A. Van Brunt, who is now electrical editor.

In December, 1927, *Industry Illustrated* was consolidated with *Industrial Engineering,* under the ownership of the McGraw-Shaw Company, now a division of the McGraw-Hill Publishing Company, Inc., of New York, N. Y. Since that time it has been published in its present form. The present editor took charge in November, 1928.

The staff of *Industrial Engineering* consists of: L. C. Morrow, editor; Wilbur A. Beck, managing editor; G. A. Van Brunt, electrical editor; and William Staniar and F. M. Gibson, consulting editors.

What Becomes of the Men Replaced by Machines?

AS MORE productive equipment takes its place in industry what becomes of the men it replaces? The answer is that new industries and new occupations rise to give employment to the man power freed by the machines.

While one group of engineers is working might and main to provide machines to put men out of work, another group is working just as hard to create new commodities, the making of which will give men work.

The harvester and binder took work from a few people for a short time, but made today's agriculture possible. The steam engine undoubtedly cost some men their jobs, but consider the multitudes now employed because of it. The automobile has run a similar course, as will the airplane. The typesetting machine is an outstanding example.

Then there are the by-product jobs. Tractors must be made to furnish for the agricultural machines a power of locomotion that will match their capacity. Crews must be provided for trains, groups to lay tracks, stations must be built. Service and repair stations must be supplied to look after automobiles and airplanes. Presses must be provided to make use of the product of the typesetting machine, and to keep both busy large staffs must be employed to write, to draw, to engrave, to sell.

To keep in working order the complex plants of highly productive machinery, to serve production, the division of plant engineering has arisen in industry.

Moreover the increasing productive capacity of the machine is responsible for the cycle of more production, higher wages, more buying power, more demand, back to more production. It is to the individual's profit as well as for the good of all that he do his share toward the adoption of the most productive equipment for any given job.

Mechanics Lead in Intelligence

MECHANICS constitute the nation's most intelligent class, according to tests recently reported upon by Dr. E. E. Free, scientist. Dr. Free defines intelligence "roughly, but workably, as the ability to reach a reasonably correct conclusion from a set of discoverable facts." He includes in the mechanic group foremen-mechanics, chief riggers, millwrights, and precision machinists.

Note that conclusions must be reached from facts. There is the explanation of the mechanic's intelligence. He is trained to get results from the mechanisms with which he deals; if they are out of order there is a cause for the failure to function. His the job of finding the cause, before specifying the correction.

Or perhaps a mechanism is to be constructed to perform a certain function. Judgment as to the kind of mechanism, its strength, its form, must depend upon a knowledge of facts concerning the work to be done, the physical limitations of the space within which it must work, the man or machine power available. Guessing does not go.

The men charged with the engineering of plants, that is, the mechanical, electrical and structure services, usually are, or have been, mechanics. Of them, few cannot turn their hands, if need be, to the actual performance of the tasks of their departments. They have long held in the esteem of their fellow workers the place in which they are now ranked by Dr. Free.

QUESTIONS *Asked and Answered* *By Readers*

[HERE IS A PLACE *where you can get some inside information when you get stuck. The only restriction is that you do a good turn to the other fellow when he asks a question that you can answer from your experience*]

What Changes Are Required With This Generator?

Will some reader suggest the best and most economical method of adapting a d.c. 15-kw., 125-volt, 120-amp., 1,500-r.p.m. G.E. generator for welding purposes? We have this generator which is driven by an a.c. motor on hand and would like to use them in this manner.

Wappingers Falls, N. Y. W. F. S.

* * * *

How to Keep Unused Paint

What is the best method of preserving unused paint so that it may be used later on? I have experienced a great deal of trouble and lost considerable good paint through lack of knowledge on this point. A. M.

Des Moines, Iowa.

* * * *

Fault Finder for Locating Leaks in Water Lines

I would appreciate it if some of the readers would give me information on constructing a fault finder for locating leaks in water lines below the ground level. Diagrams, of course, are desirable and preferred, or a diagram for building a wireless pipe locator for locating underground pipe lines.

West Pullman, Chicago, Ill. W. A. B.

* * * *

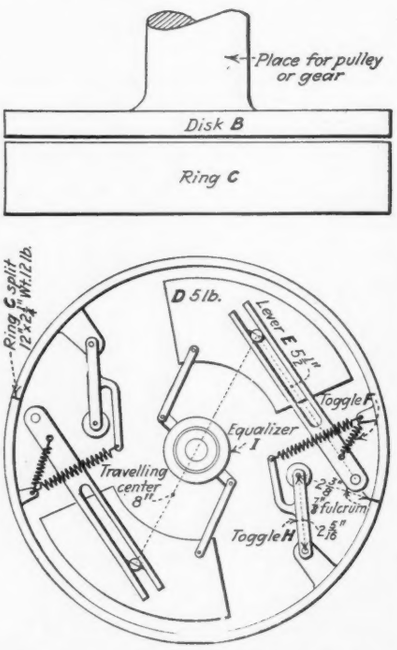
Clutch Calculations Are Unsatisfactory

The accompanying illustrations refer to a clutch problem that I ask the readers to help me solve. The information wanted is, how do you calculate the centrifugal force, and the horsepower transmitted by this clutch?

I have followed the rules and formulas in Kent's Mechanical Engineers Handbook but I am not satisfied with the results.

This clutch is built in three parts, a bell *A*, a disk *B* and a ring *C*. The bell is attached to both shafts but does not transmit power. The disk serves to accommodate the pulley, and the stud of the inside mechanism. The ring is split in two as shown. It is 12x2¼ in. and weighs 12 lbs. Speed 500 r.p.m.

The disk and ring are inserted inside the bell. Attached to the ring, is a 5-lb. weight *D*, which is also attached to a 5½-in. lever *E* which is attached to toggle *F*. This toggle is ⅞ in. from



SECTION VIEWS of clutch made up of a bell, a disk and a ring showing mechanism common to each.

the fulcrum and at an angle of 45 deg. The weight has a traveling center of 8 in. A spring *G* is attached to the ring *C* that serves to pull the weight back when it stops. The spring *G* is attached to toggle *H* which is 2 7/16 in. long and it is pivoted on one end 2⅜ in. from ring *C* and 1 in. from the other end. The center is provided with an equalizer *I* which is loose on disk *B*.

Ample information should be given so that I can follow the step-by-step procedure and apply it to similar equipment. E. R.

Lowell, Mass.

Effects of Induction Voltage Regulators

I wish some reader would explain the effect of using two single-phase induction voltage regulators on a three-phase circuit. Are all of the phases affected? If so, to what extent is the third phase affected on balanced and unbalanced loads? Please explain. O. B. L.

Sistersville, W. Va.

* * * *

Mounting Meters to Avoid Effect of Vibration

We have to install a number of watt-hour meters on walls and panels that are subjected to considerable vibration. This condition cannot be avoided. I should like to know (1) what effect will vibration have on the operation of these meters? (2) Will readers who have had to meet this problem tell me the best way to mount watt-hour meters so as to minimize or eliminate the effect of vibration? J. R. C.

Brooklyn, N. Y.

* * * *

What is the Best Method of Stopping this Crane?

I shall appreciate it if readers will help me solve the following problem. We are putting up a new crane runway, on which there will be three electric traveling cranes, two of which will be of 10-ton capacity, and one of 50-ton capacity.

The 50-ton crane is to operate only on certain sections of the runway, which will be reinforced. We do not want this crane to go on the part of the runway that is not reinforced, but the runway must be free of bumpers at each end of the reinforced section, so that the 10-ton cranes can work in this section.

Stopping of the 50-ton crane at the ends of the reinforced section must be effected electrically and automatically, and so arranged that by resetting the relay or some other device the crane can be moved back into its own section. How can this best be accomplished? G. J. K.

Vandergrift, Pa.

ANSWERS *Received to Questions Asked*

Chord Factor of Concentric Winding

I shall appreciate it if some reader will answer the following question: A three-phase, six-pole induction motor stator has 72 slots and is wound with concentric coils placed in slots 1-16, 2-15, 3-14, 4-13, etc. What is the chord factor of this winding? In general, what is the proper method of calculating the chord factor of concentric or pyramidal coil windings? I have seen this factor calculated in two different ways, but the results obtained by the two different methods do not coincide.
New Westminster, B. C., Canada — W.L.S.

REGARDING the question by W. L. S. in a recent issue, the total chord factor for the pole phase concentric group can be figured in two ways, both being the average. The most accurate of the two is based on the sine of one-half the angle (electrical) spanned by each coil.

The motor in question has 72 slots and 6 poles or 12 slots per pole and the span of any two slots is 180 ÷ 12 = 15 deg. Then with the grouping of 1 and 16, 2 and 15, 3 and 14, 4 and 13, we derive the following chord factors:

1 & 16 = 15 or 15 × 15° = 225°
225° ÷ 2 = 112″ 30″ whose sine = 0.92388

2 & 15 = 1 & 14 or 13 × 15° = 195°
195° ÷ 2 = 97° 30″ whose sine = 0.99144

3 & 14 = 1 & 12 or 11 × 15° = 165°
135° ÷ 2 = 67° 30″ whose sine = 0.99144

4 & 13 = 1 & 10 or 9 × 15° = 135°
135 + 2 = 67° 30″ whose sine = 0.92388

Total = 3.83068

Average chord factor = 3.83068 ÷ 4 = 0.95767.

The other method is to average the number of slots spanned, as follows:

1 & 15 = 15 slots spanned = 3 slots over pitch or, 12 — 3 = 9 or 1 & 10.
2 & 15 = 1 & 14 or 13 slots spanned = 1 slot over pitch or, 12 — 1 = 11 or 1 & 12.
3 & 14 = 1 & 12 or 11 slots spanned = 1 slot over pitch or, 11, or 1 & 12.
4 & 13 = 1 & 10 or 9 slots spanned = 3 slots over pitch or, 9, or 1 & 10.

The average pitch equals (9 + 11 + 11 + 9) ÷ 4 = 10 or 1 & 11. Chord factor of 1 & 11 = 10 × 15° = 150° ÷ 2 = 75° whose sine equals 0.96592 which is slightly different to the average value obtained by using the chord factor, but the difference is so slight and the method so much quicker that using a slot method is better.

The difference between the two methods is as follows: chord factor average equals 0.95766 and 1.0 — 0.95766 = 0.04233, or the chording reduced the turns 4.233 per cent, then the chord factor of the average slot pitch reduced the turns 1.0 — 0.96592 = 0.03408 or 3.408 per cent and the difference between the chord factor average method and the chord factor of the average slot method equals 0.04233 — 0.03408 = 0.00825 or 0.825 per cent, which is less than one per cent and is not worth the extra work involved to use the chord factor method.

However, the chord factor method has the one advantage of giving a correct average and it takes care of over-pitch coils as well as under-pitch coils. For example, compare the chord factor of the 1 and 16 coil pitch with that of the 4 and 13 coil pitch. Both are the same, which proves that over pitch has the same effect as under pitch.

With the average slot-pitch method, the full pitch must be known and all over-pitch coils reduced to terms of under pitch before a true average can be had.

Or consider the 1 and 16 coil which spans 15 slots and the 2 and 15 coil that spans 13 slots, then if we were to use the value 15 and 13, we would get an average slot pitch of (15 + 13 + 11 + 9) ÷ 4 = 12, or 1 and 13, which is equal to full, or 100 per cent pitch.

This indicates that over pitch must, in all cases when using the average slot method be reduced to under-pitch terms.

If the foregoing points are watched, then the average slot method can be used with close results. A. C. ROE.
Wilkinsburg, Pa.

How Can Better Painting Results Be Obtained?

Our production program calls for constant operation; in other words, we run both day and night up to Saturday noon. The plant is closed down from Saturday noon to Monday morning. Manufacturing processes are done in the presence of a great amount of moisture, heat and more or less condensation during the winter months. As a consequence it is almost impossible to have dry surfaces to paint over them. What can we do to insure better results than we are getting at the present time? We realize that conditions are bad, but believe that there must be some way of minimizing their effects.
Woonsocket, R. I. — R.E.S.

ON THE FACE of the question asked by R. E. S., I would say that this is a tough proposition. One of the prime requisites of successful painting is proper surface conditions. Fully 75 per cent of paint failures can be traced to lack of surface preparation either through carelessness, lack of knowledge, or inability to have surfaces brought to fair painting condition. The particular situation described falls in the latter classification.

Many industrial plants are faced with this condition but do not have such a strenuous production program and as a consequence could do a great deal toward proper surface preparation. As a matter of fact, many plant engineers while realizing the necessity of surface preparation are not willing to invest the money that is necessary in such work; as a consequence they always have protection problems with short life for whatever paint protection surfaces receive. With all the educational literature that can be obtained on this subject, it would seem that there is no excuse for lack of knowledge to insure adequate preparation.

Relating directly to the problem mentioned here, there are some things that plant engineers could do under these conditions that would help a great deal. The presence of moisture in a wood or concrete surface is the most common cause for subsequent paint failure. The first thing to be done, therefore, is to devise ways and means for driving this moisture out of the surface to as great an extent as possible in order to insure a fairly satisfactory result.

For instance, immediately on the completion of Saturday's work at noon, turn on the heat which usually is supplied through exhaust steam or live steam from boilers and open all doors and windows. Rig up auxiliary fans at chosen points to set up an artificial current of air. This will hasten the drying out process. If conditions are so bad that it is out of the question to dry these surfaces to the point where paint may be applied either Saturday afternoon, or Saturday night to Sunday noon, then the drying out process should be continued along these lines until process work starts again on Monday morning. In some cases it may be possible to suspend waterproof canvas from the ceiling and thus cover up a great deal of the ceiling surfaces so that normal operations can be maintained during the following week. The canvas will prevent a great deal of penetration into the partially dried surfaces.

Then on the following week-end continue the drying out process, say until Sunday morning at which time the painting could be done. The first coat properly prepared for application could then be applied. Canvases could be rehung to protect this first coat over the following week, taken down Saturday at noon, have heat and air turned on again and the second coat applied in the same manner. In the application of the first coat many companies have found the application of one of the china wood oil varnishes a decided advantage in the presence of a great or less amount of moisture.

It is needless to say that after surfaces have been dried out as far as possible, all rust spots on metal should be cleaned down to the bare surface. Scaling or peeling paint should be removed and all surfaces made in the best possible painting condition.

Each industrial plant can work out details of surface preparation to meet the conditions. Where painting conditions are abnormal as reported in this instance, however, the plan is certainly well worth trying. ROY C. SHEELER.
Assistant Manager,
Prescription Paint Service Department,
E. I. du Pont de Nemours & Company,
Philadelphia, Pa.

NEW EQUIPMENT

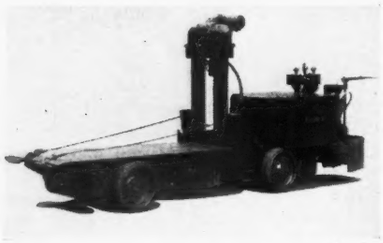
For Plant Operation and Maintenance

Industrial plant executives concerned with the selection and operation of mechanical and electrical equipment will be interested in these new devices which are designed to improve plant operation or reduce operating and maintenance costs.

Baker-Raulang Storage Battery Truck

AN ELECTRIC storage battery truck which will load 10-ton packages of sheet steel into box cars has been developed by the Baker-Raulang Company, Cleveland, Ohio. This new truck is known as the Baker Type D-96 articulated tilting truck. It is hinged in the center. This hinge enables it to make the very short turn from the loading dock through a 7-ft. car door with a 48x102-in. package.

The power section of this truck carries the battery, driving and steering apparatus. The load section consists of a tilting platform mounted on a single axle and includes the hoist for tilting the platform and a double-drum power winch.



Baker-Raulang Type D-96 Articulated Tilting Truck

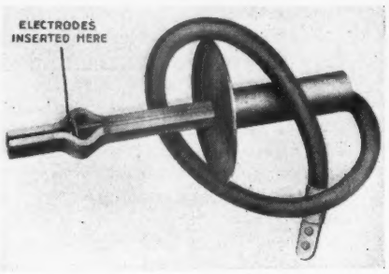
Sheets larger than 48 in. wide and 102 in. long can be handled, but automobile cars with 10-ft. door widths are required. This same truck may be used for unloading cars by using the cables to pull the package up onto the truck platform.

Fusion Electrode Holder

AN ELECTRODE holder for metallic arc welding which has several unique points of advantage has been brought out by the Fusion Welding Corporation, 103d St. and Torrence Ave., Chicago, Ill. This electrode holder is to obviate the overheating of the electrode due to improper contact in the electrode holder.

The act of inserting the electrode in this Fuzon Model A holder automatically scrapes off any insulating material that may be present on the welding rod, insuring four clean points of firm contact and thereby minimizing the overheating of the electrode.

This holder has no springs or moving parts. The jaws are made of the same special copper alloy that is used to support and attach trolley wires to the cross wires. It is very easy to load and when the electrode has been inserted between the jaws it may be placed at any desired angle to facilitate work in difficult welding positions. The insertion of a fresh electrode automatically ejects the stub end of the old electrode without the welder touching it. It is furnished with or without sweated-in flexible cable.



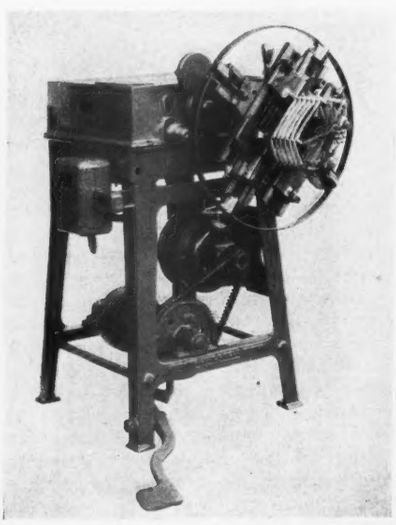
Fusion Welding Corporation Fuzon Model A Electrode Holder

Mutual Coil Winding Head

MARKETING of a group winding head has been announced by the Mutual Foundry & Machine Company, Atlanta, Ga. The illustration shows this winding head mounted on a standard winding stand.

With this winding head coils can be made singly or in groups of two, three, four or six; or it is possible to wind three sets of two coils in groups, two sets of three coils, or one set of four or six groups. It is provided with a lead-holding device that will hold up to four wires at a time and can be placed in any desired position on the head. There are six independently adjusted points of contacts which make it possible to wind practically any shape of armature coil. The head can be adjusted to wind loops ranging from $4\frac{1}{2}$ in. in length and $2\frac{1}{4}$ in. span to 20 in. in length with 14 in. span. Special attachments can be supplied for winding field coils of a wide variety of sizes and shapes.

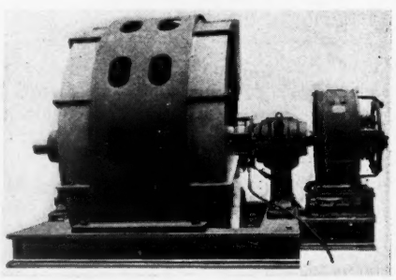
When the coils are wound and tied in the usual manner turning a handwheel one-half turn to the left and pulling a lever forward brings the fingers in 1 in., which gives $\frac{1}{2}$-in. clearance for sliding the coils off the head.



Mutual Universal Group Winder on Browning Winding Stand

Fabricated Horizontal Generators

THE Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa, has announced that in the manufacture of horizontal generators for waterwheel drive, fabricated steel will be employed for the stators, rotors and bedplates. Progress in electric arc welding is responsible for abandoning the use of castings. The use of fabricated structural pieces, heretofore impossible because of space limitations in the generators, offers greater ruggedness, and lighter weight than could be attained with steel castings.

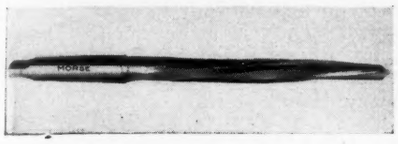


Westinghouse Fabricated Steel Generator for Waterwheel Drive

The standard horizontal generator unit is of the two-bearing, coupled type, and may be arranged for an extended shaft for an overhung water wheel runner. Due to the fact that hydroelectric requirements are varied, the Westinghouse Company has developed several different rotor designs. When comparatively low peripheral speeds are to be used, a fabricated steel spider with bolted-on or dovetailed poles is usually employed. For higher speeds, laminated steel or steel plate construction may prove more applicable. The field poles are of thin steel laminations, riveted together with overhanging pole tips to give support to the field windings.

Morse Spiral Groove Reamer

DEVELOPMENT of a three-groove structural reamer has been announced by the Morse Twist Drill & Machine Company, New Bedford, Massachusetts.



Morse Three-Groove Structural Reamer

This reamer is adapted for boiler or other work that requires aligning or enlarging holes in plate or structural steel by means of air or electric drills. Among the special features are a large chip area, double cleared, and a design of cutting edges that gives a shearing cut with graduated taper.

These reamers are stocked in the following sizes: $\frac{13}{32}$ in. to $\frac{25}{32}$ in. in $\frac{1}{32}$-in. steps, and from $\frac{25}{32}$ in. to $1\frac{1}{2}$ in. in steps of $\frac{1}{32}$ in.

Ohio Brass Mine Harp

A TURRET-TYPE mine harp and pole head casting for wheel and glider operation has been announced by the Ohio Brass Company, Mansfield, Ohio.

This device is known as the turret type because of the turret-shaped bearing between the pole head casting and the swivel harp casting. A projecting turret on the pole head casting $1\frac{1}{2}$ in. in diameter and $1\frac{1}{8}$ in. high, fits into a corresponding socket on the harp casting, making a smooth machined bearing of large area. Both harp and pole head casting are made of Flecto malleable iron.

The bolt in the new design is used only for holding together the assembly, and is not depended upon for strength and electrical conductivity. The turret construction evenly distributes the pressure caused by pole tension.

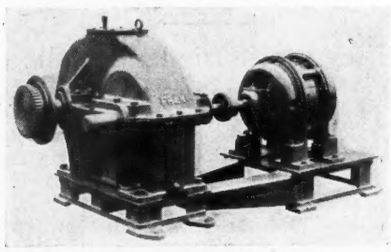
The harp for glider operation also utilizes the turret principle, but is somewhat different in design from the wheel harp. Connection between the glider and harp is made by large ball-and-socket joints. Heavy copper bearing washers are fitted between the ball-and-socket joints and the wear at these joints falls on the washers.

The glider itself is pivoted at the center of contact. Where very heavy service is encountered and extremely high currents are used, a copper shunt is used to carry the current from the glider around the harp to the terminal on the pole head casting.

Ohio Brass Turret-Type Mine Trolley Harp (right) and Trolley Shoe (left)

Falk Welded-Steel Motor Bed

A COMPLETE line of welded-steel motor beds has been added to that of standard speed reducers by the Falk Corporation, Milwaukee, Wis., the addition of which means that each unit can be had with a welded-steel or a cast-iron motor bed. When a speed reducer



Falk Welded-Steel Motor Bed for Speed Reducers

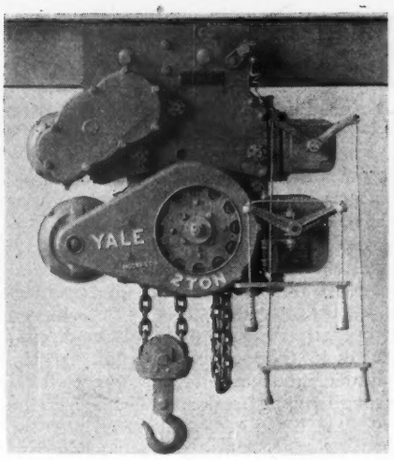
is mounted on timbers, structural steel or any foundation other than concrete, there is advantage in using welded-steel motor beds because of the greater strength. A double-reduction unit mounted on a welded motor bed is shown in the accompanying illustration.

Yale Motor-Driven Trolley

A MOTOR-DRIVEN trolley designed to carry capacity loads of from one to three tons, and which can be adjusted to fit all standard I-beams of from 8 to 18 in. in depth has been developed by the Yale and Towne Manufacturing Company, Stamford, Conn. Power is transmitted from a $\frac{3}{4}$-hp., a.c. or d.c. motor through the inclosed spur-gear reduction which operates in an oil bath, directly onto two wheels of the trolley. The design provides for the ready attachment of a Yale Electric Chain Hoist or a Yale Chain Block of the hand type. A horizontal speed of approximately 150 ft. per minute can be obtained.

The combination distance from the underside of the I-beam to the load hook is 29 in. on the 1-ton electric chain hoists, and 35 in. on the 2-ton hoist.

The trolley is arranged for either manual or push-button control. Where very quick stopping is necessary, the driving motor can be provided with a solenoid electric brake which operates directly on the motor-driven shaft. This brake is released or applied the second that the power is applied or cut off.

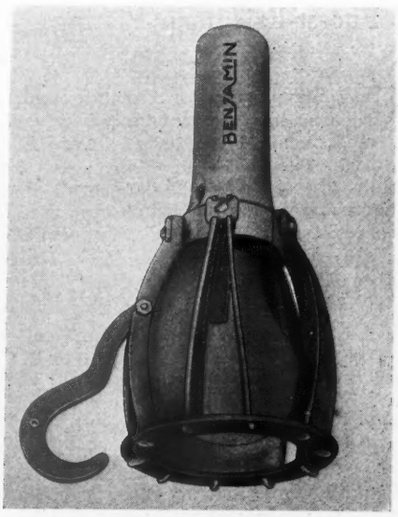


Yale and Towne Manufacturing Company Motor-Driven Trolley

Benjamin Portable Hand Light

THE DEVELOPMENT of a portable hand light having a fiber guard with an adjustable hook has been announced by the Benjamin Electric Manufacturing Company, 128 So. Sangamon St., Chicago, Ill. The handle is of varnished hard maple to which is attached a notched fiber guard that prevents the light from rolling when placed on a flat surface.

A special floating socket and four flexible springs absorb shocks that would otherwise be transmitted to the lamp filament. This portable device will take lamps of from 25 to 60 watts capacity. A fiber half-shade is attached inside the guard to direct the light rays.

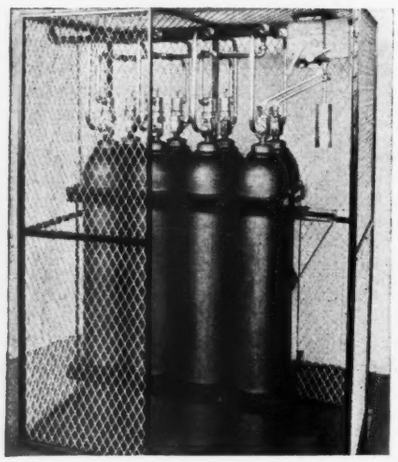


Benjamin Electric Manufacturing Company Portable Hand Light

American-La France-Foamite Alfite System

A SYSTEM of carbon dioxide protection against fire known as the "Alfite" system has been developed by the American-LaFrance and Foamite Corporation, Industrial Fire Equipment Division, Utica, N. Y. This system employs an inert gas that is confined in a liquid state in metal cylinders under a pressure of from 900 to 1,000 lb. When the system is placed in operation a plunger ruptures a copper disk that seals the gas in the cylinder, and permits the gas to pass through piping to nozzles located at the fire. Here the gas is liberated into the room or space being protected where it expands and dilutes the air so as to smother the flame.

The system may be operated manually, semi-automatically, or automatically. A variety of operating devices are available, thus giving the system a flexibility enabling it to be applied to widely diversified conditions.



American-La France-Foamite Alfite Fire-Protection System

Fuerst-Friedman Plating Tank Rheostat

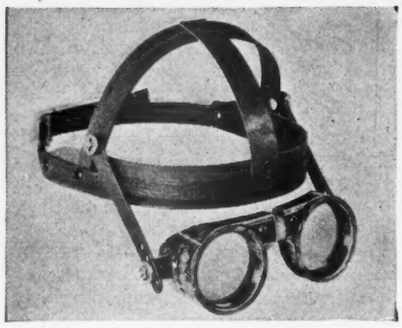
THE manufacture of a plating tank rheostat has been announced by the Fuerst-Friedman Company, 1292 E. 53rd St., Cleveland, Ohio.

This rheostat is a standard grid, although of the multiple switch type used as a resistor.

Oxweld Helmet Goggles

ACCESSORIES for welding and cutting recently added to the line of the Oxweld Acetylene Company, 30 E. 42nd St., New York City, are the Oxweld cap and skeleton-type helmet goggles.

The No. 9 cap type goggles consist essentially of a strong fiber cap, to which a pair of goggles is attached by means of fiber links. The goggles can be readily raised over the forehead or lowered over the eyes with one hand. The bridge is adjustable and is covered with rubber insulation. Replaceable lenses, in the same size and colors as are supplied in Oxweld No. 6 goggles, are used, the colored lenses being protected by cover lenses of clear glass.



Oxweld Acetylene Company No. 10 Skeleton Type Goggles

The No. 10 skeleton type goggles shown in the illustration are the same as the cap type except that the goggles are attached to a lattice skeleton cap. Both styles are provided with leather straps at the rear for head-size adjustment.

Hisey-Wolf Grinder Treadle Switch

FOR the purpose of saving power by insuring that grinder are not allowed to run when not in use, the Hisey-Wolf Machine Company, Cincinnati, Ohio, has developed the foot treadle switch shown in the illustration. This treadle switch is available on all Hisey motor-driven grinding and buffing machines. In order to use the grinder the operator must push the treadle down with his foot and keep it there until he has finished. When the foot is removed the grinder stops.

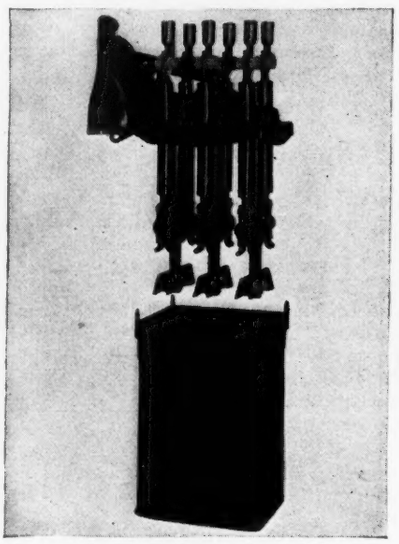
The treadle extends the entire width of the column, allowing simultaneous operation by two workmen without interference. In addition to its convenience of operation this treadle switch presents all of the safety and automatic features of push button control.

Another development is the automatic grinder lights that burn only when the grinder is being used. They are turned on or off automatically when the motor control switch is manipulated. These lamps are supported by flexible metal holders that permit them to be placed in any desired position.

Hisey-Wolf Grinder with Foot Treadle Switch and Automatic Lights

G. E. Circuit Breaker

TYPE FK-33 is the designation of an oil circuit breaker announced by the General Electric Company, Schenectady, N. Y., for manual or electric operation. These breakers are rated 4,500 volts, 200 and 400 amp. two-, three- and four-poles, single, and double-throw, and have interrupting capacities of approximately 20,000 kva. at the rated voltage.



General Electric Type FK-33 Oil Circuit Breaker

The Type FK-33 oil circuit breaker is designed for use in industrial installations, and for stations where a substantial breaker of moderate interrupting capacity is required.

Torchweld Cutting Torches

AMONG the devices recently brought out by the Torchweld Equipment Company, 224 No. Carpenter Street, Chicago, Ill. are the No. 18 MC one-piece-tip cutting torch, and the No. 28 MC two-piece-tip cutting torch. These torches have metal-to-metal seats on their high- and low-pressure lines, with positive flash back and back pressure safety features. These torches are made from die-pressed metal and solid brass bar stock.

There is also a new cutting attachment for several models of Torchweld torches, that can be used for cutting metal up to 8 in. in thickness.

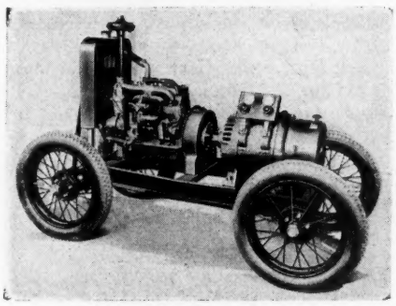
Fuzon Portable Arc Welder

ANNOUNCEMENT is made by the Fusion Welding Corporation, 103rd Street & Torrence Avenue, Chicago, Ill. of a portable, gasoline-engine-driven arc welding outfit.

These welding outfits are available in two sizes, of 200- and 300-amp. rating, respectively. A 23-hp. Continental gasoline engine furnishes the power for the 200-amp. outfit, whereas an engine of 40-hp. rating is used for the 300-amp. machine. An automatic governor keeps the engine speed constant.

A patented method of interpole connections in the generator, it is claimed, puts an inherently stabilized current into the welding line and makes unnecessary the use of induction coils, reactors, and the like heretofore used to help stabilize the arc. Another feature is the single brush shifting control, calibrated in amperes, which gives an infinite number of current settings.

As will be seen from the illustration, these welding outfits are mounted on large, rubber-tired, automotive-type wheels which make it possible to take this welding outfiit anywhere that a car can be driven.



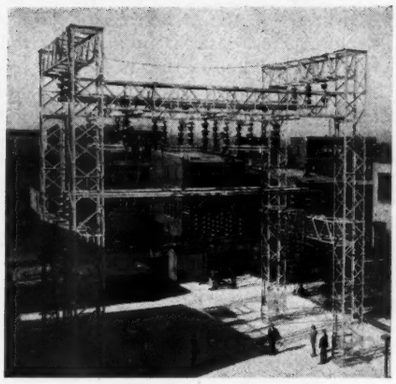
Fuzon Portable, Engine-Driven Arc Welder

Delta-Star Outdoor Substation

THE Delta-Star Electric Company, 2400 Block Fulton St., Chicago, Illinois, announce a different type of outdoor substation in which, by means of rotating bus and switch combinations, the number of insulators used on the older forms of stations has been cut in half.

With the usual form of station, the connections between equipment are purely electrical and serve no mechanical purpose, such as would a disconnecting switch serving both as an electrical conductor and a mechanical device. Large numbers of insulator units are required for these idle connections.

The substation shown in the illustration is built more like a switch gear with two sets of buses mounted one above the other. The bus selector switches are so designed and placed that in themselves they form the tap-off connections from buses to disconnecting switches for the oil switch.



Delta-Star Type F Outdoor Substation

The stationary contacts for the disconnecting switches are mounted directly on the buses themselves, the switch blades forming tap-off connections from the main buses. The rotating buses on which the blades are mounted complete the connection to the disconnecting switches.

This design of substation is especially adapted for 66 kv. and above.

Trumbull Inclosed Switch

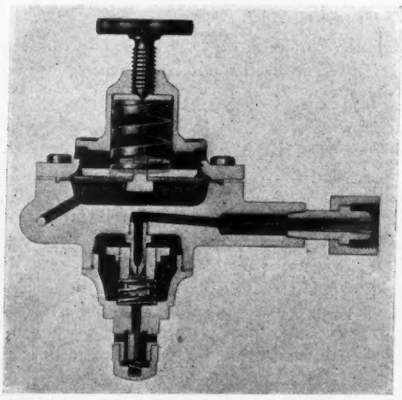
AN ADDITION to the magnetic switch line brought out by the Trumbull Electric Manufacturing Company, Plainville, Conn., is the "R. M." Switch combined with a magnetic switch in the same cabinet. Each switch is furnished with overload and under voltage devices.

Four separate group combinations are available for one size of box, and both switches can be removed instantly by loosening the "upset" mounting screws.

Torchweld Oxygen Regulator

MARKETING of an oxygen regulator with safety release valve has been announced by the Torchweld Equipment Company, 224 N. Carpenter Street, Chicago, Illinois.

The safety valve is fitted to the back cap of the regulator and is automatic in operation. It can be put on all Torchweld regulators now in use.



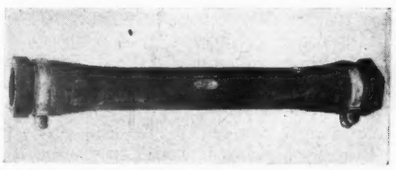
Torchweld Oxygen Regulator with Safety Release Valve

When the oxygen pressure becomes excessive in the regulator body the safety valve permits gas to escape through an opening in the back cap until the pressure is again normal. As shown in the illustration, the safety feature is simple, consisting only of a spring plunger seating on a machined surface in the back cap, a plunger, and the valve cap.

The regulator body is provided with a three-ply diaphragm of the self-centering type, with a simple means of maintaining uniform tension. Sturdy brass forgings are used throughout in the construction of this regulator.

Chicago Pump Vibration Arrestor

WHAT is designated as the Vib-Restor has been introduced by the Chicago Pump Company, 2336 Wolfram Street, Chicago, Ill. This device is a length of special rubber hose which takes the place of metal piping between the intake and the pump and between the pump and the outlet, its function being to absorb all vibration caused by the operation of centrifugal pumps.



Chicago Pump Vibration Arrester for Centrifugal Pumps

The rubber hose used has flared ends built up to make the inside diameter uniform throughout. This feature enables the hose section to pass as much water as the pipes to which they are attached.

The pipe couplings at the ends of the hose are heavy malleable castings which it is claimed will withstand much more pressure than the connection will be called upon to hold.

Chicago-Jefferson Outlet Box

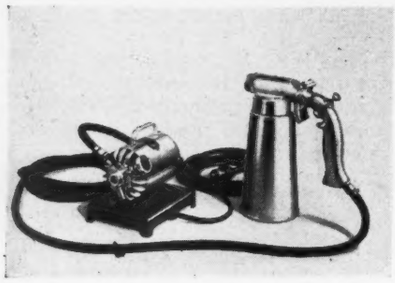
AN OUTLET box with a reversible clamp and bushing plate for side or bottom knockouts and suitable for use with metallic cable, non-metallic sheathed cable or loom is announced by the Chicago-Jefferson Fuse & Electric Company, 1500 South Laflin Street, Chicago, Ill. The main feature of the No. 1288X box is the unique type of clamp which is reversible, so that the cable may be brought in from either the side or bottom knockouts.

The clamp is provided with bushed holes and eliminates the necessity for the bushed flange plate such as furnished on the 1289X box or a brass ferrule.

It permits the use of any type fixture stud and hickey in the smaller 3¼-in. box, and permits maximum wiring space. The box is finished in either black enamel or galvanized.

Atomister Portable Spraying Machine

INSTANTANEOUS control and light weight are among the principal features offered by the Atomister Corporation, Rahway, N. J., in announcing the development of the Model B Atomister which was designed to spray paint, lacquer, enamel, bronze, varnish, stain, shellac, whitewash, insecticides and disinfectants.



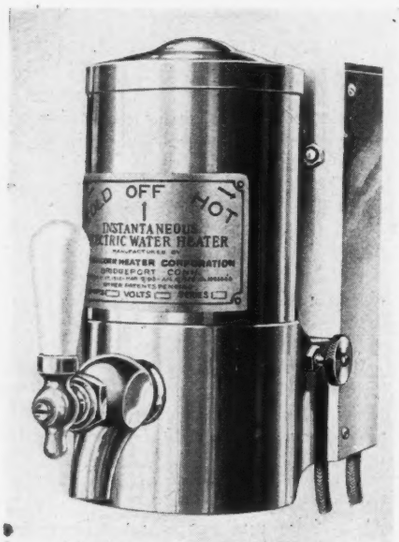
Atomister Corporation Model B Atomister

In this device the spray gun and container are combined in a compact unit weighing one pound. The compressor, which weighs 5 lb., rests on the floor. This arrangement permits the user to hold only the spray gun and container, thereby making it easier to handle.

Acorn Electric Water Heater

AN ELECTRIC water heater which it is said will deliver an unlimited supply of hot water upon turning the faucet has been put on the market by The Acorn Heater Corporation, State and Bostwick Aves., Bridgeport, Conn. This heater is available in the single-, four- and twelve-faucet types.

This is not a lamp socket device, but is designed for permanent installation, although no additional plumbing is required. The water passes directly over a non-corroding heating element which is threaded through 22 tubular passages.



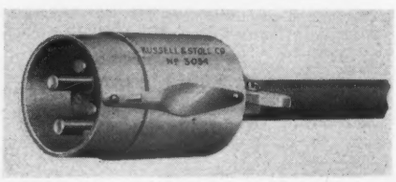
Acorn Electric Water Heater

The faucet handle controls both the flow of water and the switch controlling the heater. Hot water is obtained by moving the handle to the right, and cold water by moving it to the left. When the handle is moved to the upright position, current and water are simultaneously cut off, as current is used only when hot water is actually being drawn.

This heater is also provided with a small temperature control valve.

Russell and Stoll Wiring Devices

INTRODUCTION of a two-gang, four-wire receptacle and plug for use with the recently developed high-cycle portable tool equipment such as reamers, grinders, screwdrivers, and so on, has been announced by the Russell & Stoll Company, 53 Rose St., New York, N. Y. These devices have a rating of 10 amp. at 250 volts and 15 amp. at 125 volts. The receptacle will fit various standard outlet boxes.



Russell & Stoll Four-Wire Duplex Receptacle and Plug

The plug housing is of cast aluminum and is provided with a rugged, cable-gripping device. The interior of the plug and receptacle is of molded Bakelite, and phosphor bronze spring contact members are employed. These are designed for polarized operation.

In this equipment provision has been made for meeting the latest grounding requirements for all portable tools and devices.

Stephens-Adamson Belt Conveyor Carrier

AN IMPROVED type of hand bracket has been designed by the Stephens-Adamson Manufacturing Company, Aurora, Ill. for its Sacon carrier. This outer support bracket fits close to the pulley end, thus eliminating any chance of lumps lodging between the pulley and the bracket. It also furnishes additional protection for the end bearings, which are likely to be exposed to moisture, dust and grit.

Stephens-Adamson End Bracket for Sacon Carriers

Sacon carriers are made with either ball or roller bearings mounted in dust-tight, self-aligning housings and the improved end stands are standard for all sizes carrying from 24- to 48-in. belts.

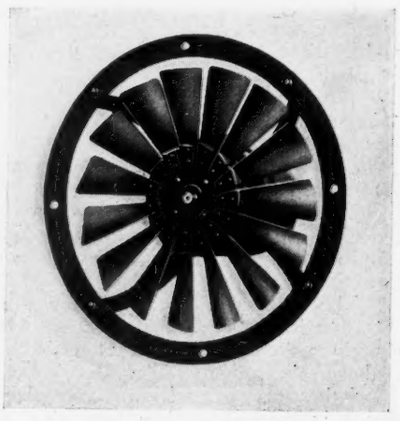
Cincinnati Locomotives

THE MARKETING of a complete line of industrial locomotives in the gasoline, gasoline-electric, Diesel, electric-trolley and storage-battery types that will be known as the "Cincinnati Line," has been announced by the Cincinnati Car Company (Locomotive Division), Cincinnati, Ohio. These locomotives will be furnished in a variety of sizes from small 2- and 3-ton units up to 50 tons or larger, and in various track gages, affording equipment suitable for handling either small or large industrial cars.

Peerless Ventilating Fan

MARKETING of a general-purpose ventilating fan has been announced by the Peerless Electric Company, Warren, Ohio. This fan is available in the 18-in. and 24-in. types, driven by either single-phase or polyphase, 110- or 220-volt motors.

The fan blades are of special design which, it is claimed, will deliver a steady, non-pulsating current of air. The motor is fully enclosed to keep out fumes, dust, and dirt. The bearings are packed with wool, and hold sufficient oil to make oiling necessary only three or four times a year.



Peerless 18- and 24-in. Type Ventilating Fan

Appleton Connector

THE Appleton Electric Company, 1701 Wellington Ave., Chicago, Ill., announces the introduction of the No. 7280 Appleton connector, which is furnished with a U-type adjustable clamp for use with non-metallic sheath cable or loom. These connectors are provided with a copper screw on the side for grounding the neutral wire.

Another feature is the notched nut by means of which the connector can be securely fastened with an ordinary screw driver and hammer.

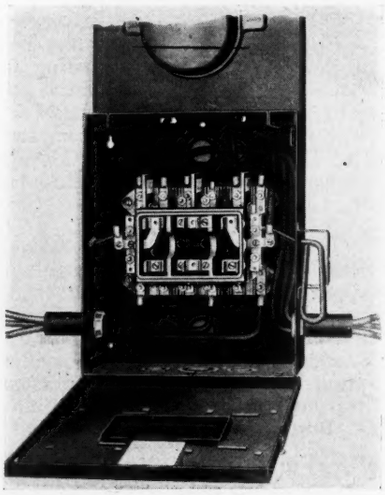
These connectors are available in the 45- and 90-deg., and double types, which are also furnished with the U-type clamp and screw for grounding the neutral wire.

Noark Polyphase Switches

DEVELOPMENT of the Noark quadbreak polyphase switches for two- and three-phase circuits has been announced by Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn. These switches are made in two general types—the meter service switch, which has full meter testing facilities, and the main entrance type in which the testing features are omitted.

One of the principal features of the switches is that the circuit is broken simultaneously at four places or rupturing points in each leg. Thus in the two-wire switch there are eight breaks in series and in a three-wire switch there are twelve breaks.

Each switching element consists of two hard copper contact plates fastened



Colt Noark Quadbreak Meter Service Switch

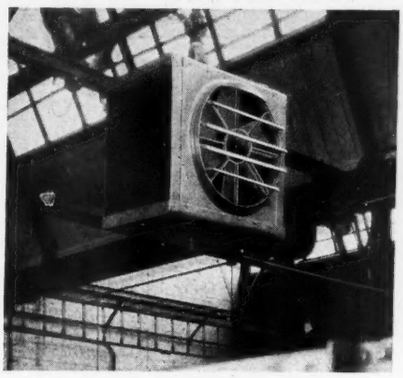
to a strip of special insulating material. As the strip is moved back and forth by the switch handle the plates open or close the circuit between spring contacts.

In the meter service switches of this type the requisite freeing of meter terminals for testing purposes is accomplished by means of the switch breaks themselves, which eliminates the use of links or contact parts for by-passing and freeing the motor terminals.

Modine Unit Heater

ADDITION of the model No. 1401 to its line of unit heaters has been announced by the Modine Manufacturing Company, Racine, Wisconsin.

The model 1401 unit heater is similar



Modine No. 1401 Unit Heater

in design and construction to the other Modine unit heaters with the exception that it uses two heating condensers, one on each end of the unit. The purpose of the extra condenser is to provide additionel heating capacity as this model is said to be the equivalent of 1,300 sq.ft. of cast iron radiation. In keeping with the other models of Modine unit heaters, the No. 1401 heater is designed to be suspended directly from the steam main, the use of pipe straps being recommended to insure a secure installation.

The capacity of this heater is 320,300 B.t.u. per hour at 5 lb. steam pressure when the temperature of the entering air is 60 deg. Fahrenheit.

Kempton E-Z Bolt Anchor

FOR anchoring bolts in concrete or other hard material the unit has been placed on the market by the Kempton Manufacturing Corporation, 148 West 23rd Street, New York City.

This unit consists of a wedge-shaped cast-iron part engaging with a lead-composition expansion member. To use this bolt anchor it is inserted, bolt head first, in a hole of suitable size and depth and the lead member expanded with a special caulking tool. As the bolt is drawn up the iron wedge further expands the lead-composition member, forcing the comparatively soft metal into the rough surface of the hole.

These bolt anchors are available in a variety of sizes for use with machine bolts ranging from $\frac{1}{4}$ in. to 1 in. in diameter.

Hubbell Wiring Devices

SEVERAL additional products have been added recently to the line of wiring devices manufactured by Harvey Hubbell, Inc., Bridgeport, Conn. Among these are a three-wire polarized, flush-type motor plug and an improved design of pull socket.

The three-wire polarized flush type motor plug is of molded composition with a $\frac{7}{16}$-in. cord hole and fits into a metal base. In the surface type of plug the base as well as the plug is of molded composition. These plugs are designed for 10 amp. at 250 volts or 15 amp. at 125 volts.

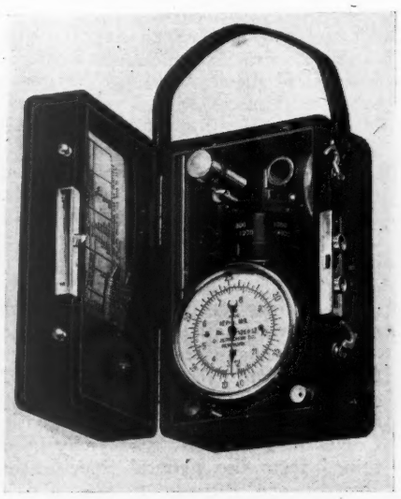
In the new design of pull socket a one-piece porcelain body is used with a simplified ratchet mechanism. The commutator contact is formed from one piece of metal which also serves as the center lamp contact. With this new construction it is claimed that there is no danger of pulling too hard on the ratchet: the chain and ratchet are stopped positively when the chain clasp reaches the chain eyelet.

Zernickow Hand Tachometer

RADICAL changes and improvements in hand tachometers have been announced by O. Zernickow Company, 15 Park Place, New York City.

The model that is now available is of the single-spindle, triple, quadruple and quintuple selective range types. The gear shift is of the rotating type. The shifting is done by turning the tachometer barrel until the desired range is in line with the dial center and an inner spring lock engages. One of the advantages of this gear shift is that there is a wide travel from one range to the next, which minimizes the possibility of error in selecting the wrong range.

The length of the instrument has been



Zernickow Hand Tachometer with Rotating Gear Shift

reduced one-third which makes for lighter weight and greater ease of handling. Speeds ranging from 20 to 40,000 r.p.m. can be measured with an accuracy of 0.5 per cent, it is claimed. Accessories include points, funnel centers and sleeves for measuring speeds of shafts under all conditions, and a rubber-bound cutmeter wheel for measuring the speed in feet per minute of belts, wheels and other moving objects.

TRADE LITERATURE

You Should Know About

Copies of literature which is described on this page can be obtained by writing to the manufacturer whose name and address are mentioned. It is always advisable to state the name and number of bulletin or catalog desired, as given in these columns.

(1) WASHFOUNTAINS—Catalog, No. 1028 "Modern Washroom Requirements," illustrates and describes the complete and improved line of Bradley Washfountains for sanitary group washing in industrial plants. The catalog also contains numerous photographs of installations and diagrams of suggested layouts for modern washrooms.—Bradley Washfountain Company, 2203 Michigan St., Milwaukee, Wisconsin.

(2) MOTORS—Leaflet GEA-78-A illustrates and describes the 5900 series GL Crane and Hoist Motors. These motors are made in two styles, type MTB and type MQC, 2 to 15 hp., totally inclosed.—General Electric Company, Schenectady, N. Y.

(3) WIRING ACCESSORIES—A completely revised catalog shows all revisions and additions of items up to the present time and contains the listing of numerous types of No-Thread Unilets as well as No-Thread Adapters, couplings and connectors for use with steel tubes.—Appleton Electric Company, 1701-1729 Wellington Ave., Chicago, Ill.

(4) UNIONS, MASTER SPECIFICATION—The Federal Specifications Board has just issued specification No. 580, which is the United States Government Master Specification for Unions, 300-lb., malleable iron or steel. This specification was officially promulgated by the Federal Specifications Board for the use of the departments and independent establishments of the government in the purchase of 300-lb. malleable iron or steel unions. The technical requirements of this specification shall become mandatory for all departments and independent establishments of the government not later than January 2, 1929. They may be put into effect, however, at any earlier date, after promulgation. Copies of this specification may be obtained from the Federal Specifications Board, care Bureau of Standards in Washington.

(5) COMPRESSORS—Eighteen questions regarding the design, construction and application of Worthington vertical Feather-valve compressors are asked and answered in bulletin No. L-620-Cl. Photographs and diagrams are included.—Worthington Pump & Machinery Corporation, 2 Park Ave., New York, N. Y.

(6) SPEED REDUCERS—Bulletin No. 190, contains much information not included in the issue it supersedes. It lists 18 additional sizes of reducers, standardized uniform ratios, simplified rating tables, besides the present line of welded-steel motor beds. In addition to the three types of herringbone gears which are described in this bulletin, there is a section composed of illustrations of installations of Falk units in the various classes of industry.—The Falk Corporation, Milwaukee, Wisconsin.

(7) ELECTRICAL EQUIPMENT—"Electrical Equipment for the Petroleum Industry" is the title of the bulletin describing the apparatus manufactured for this particular industry.—General Electric Company, Schenectady, N. Y.

(8) FLOOR LOCKS AND HOISTS—Bulletins 83-C and D, describe Revolvator and Portelator specialties, floor locks and hoists. Illustrated applications of two distinct types of floor locks are shown in bulletin 83-C, whereas bulletin 83-D shows the working parts of the self-contained hoists.—Revolvator Company, 336-352 Garfield Ave., Jersey City, N. J.

Forthcoming Meetings

Electric Hoist Manufacturers Association. Regular meeting, Hotel McAlpin, New York, N. Y., Thursday, Jan. 17, 1929. E. Donald Tolles, secretary, 165 Broadway, New York City.

(9) DISTRIBUTION TRANSFORMERS—Bulletin 160, a 52-page catalog just issued, describes single- and three-phase, pole-type and subway-type distribution transformers, in ratings up to and including 500 kva. One-half of the catalog is devoted to a detailed description of the design and construction of distribution transformers and the remainder is devoted to ratings, shipping weights and prices.—Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Missouri.

(10) MOTORS—Bulletin No. 118-E, covers type "AR" and "ARY" polyphase induction motors, and general purpose motors in the slip and roller bearing types built with steel frames.—Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

(11) PUMPS—A new publication, No. 850, describes the method used to make suction lift centrifugal pumps automatic. This bulletin, while dealing with but one automatic pumping system is of rather general interest since this is the system most commonly used.—Barrett Haentjens & Company, Hazelton, Pa.

(12) MOTORS—The rating, application and construction of the Westinghouse type HI synchronous motor together with a number of pictures are contained in leaflet L-2033-A. Typical installations in ice plants, candy factories, cold storage warehouses, theaters, etc., are shown on the last page of the leaflet.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

(13) ARC WELDING—The complete story of the application of electric arc welding in the fabrication and erection of structural steel is contained in a movie of three reels of 16 mm. film which is offered gratis for showing upon application to this company.—The Lincoln Electric Company, Coit Road, and Kirby Ave., Cleveland, Ohio.

(14) OIL BURNING EQUIPMENT—The 1928 edition of the regulations of the National Board of Fire Underwriters for the installation of oil burning equipment and for the storage and the use of oil fuel in this connection, as recommended by the National Fire Protection Association, has recently been issued.—Underwriters Laboratories, 207 E. Ohio St., Chicago, Ill.

(15) LIFT TRUCKS—"Straight Line Trucking" is the title of a folder designed to show the possibilities of the lift truck system for handling freight in railroad terminals and in the shops.—The Stuebing Cowan Company, Cincinnati, Ohio.

(16) PNEUMATIC CONVEYORS—Bulletin No. 508 contains an interesting illustrated description of the Dracco pneumatic conveying system installed in a large mining and smelting company.—The Dust Recovering and Conveying Company, Harvard Ave. and East 116th St., Cleveland, Ohio.

(17) BEARING METAL—"Common Sense About Bearings" is the title of a 32 page booklet recently issued, containing a description of the physical properties of the six standard mixtures of Bearium metal together with some interesting facts about their application.—Bearium Bearings, Inc., 261 Franklin St., Boston, Mass.

(18) POWER FACTOR CORRECTION—"Reducing the Cost of Electric Power" is the title of a new 48-page well illustrated book on the subject of power factor correction with Capacitors (static condensers). The book gives a non-technical explanation of power factor and shows when and how to apply capacitors to reduce electric power costs. The construction of Capacitors is explained also.—Electric Machinery Manufacturing Company, Minneapolis, Minn.

(19) BAKELITE—A recent folder describes some of the many and various uses of Bakelite.—Bakelite Corporation, 247 Park Ave., New York, N. Y.